American City & County

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How The Computer Is Helping To Keep Traffic Moving

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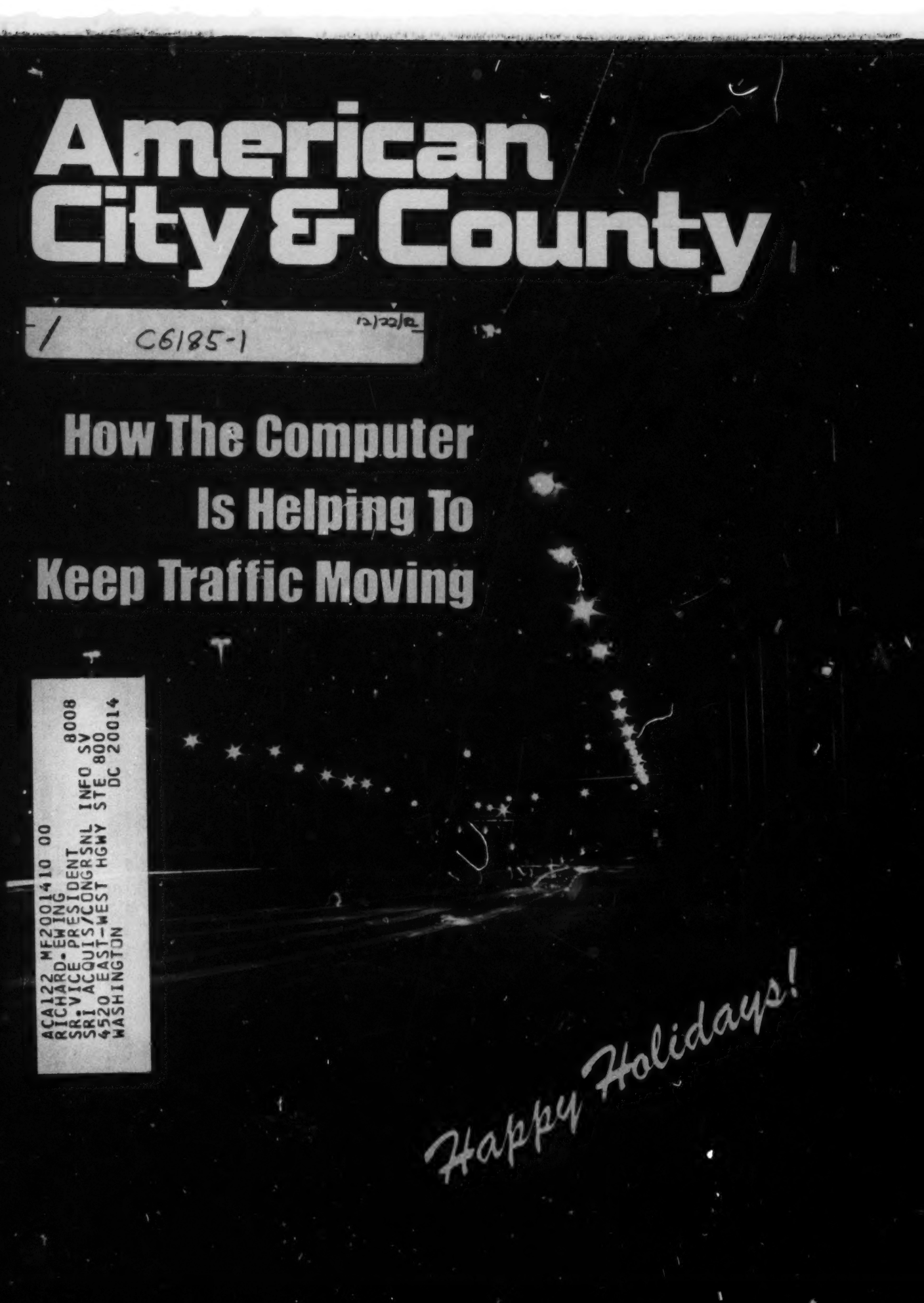

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William L. Forestell, editor-in-chief
Tel: 413/499-2550
Gary M. Chamberlain, senior editor
John P. O'Connor, engineering editor
John Foster, senior editor
Martha Elschen, computer talk
Kathleen Richards, editorial assistant
Susan O'Connor, production manager
Gertrude E. Bauer, circulation manager
June Macleod, inquiries manager
Valerie Bassett, art/production assistant
Marianne Faybik, market research director

Russell Gilchrist, publisher

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Let TRANSYT speed traffic flow

Eleven cities that recently completed traffic-signal retiming projects found that they provided significant reductions in travel time, fuel consumption, and vehicle operating costs.

By George W. Schoene and Gary W. Euler
Systems and Software Support Team
Office of Traffic Operations
Federal Highway Administration

Laymen and experts alike are familiar with the consequences of poor traffic signal operation. Both have experienced the frustration of unnecessary stops or delays at traffic signals. Both are aware of the wasted fuel and higher vehicular operating costs that result from these stops and delays, but may not be conscious of the total magnitude of the problem.

There are approximately 240,000 signalized intersections in the United States. If the hardware components of the signals at all of these intersections were modernized and the signals optimally timed, FHWA estimates that the nationwide savings would be five million gallons of gasoline per day. If the signals were optimally timed, even while continuing to operate with their existing controller equipment, the estimated savings would be two million gallons of gasoline per day.

Assuming an average gasoline cost of $1.35 per gallon, these two levels of savings can be translated into $6.75 million or $2.7 million per day in fuel costs alone. These dollar figures represent not only direct savings left in the consumers' pockets, but also the reductions in the dollars this country spends in unstable areas of the world to acquire gasoline. Interruptions in fuel supplies, similar to those of 1973/74 and 1979, would be less of a national problem.

The obvious benefits of upgrading traffic signalization led FHWA to encourage states and municipalities to sponsor signal projects that would improve the quality of urban driving, thereby reducing fuel consumption and vehicle operating costs. Timing improvements are particularly emphasized, because their costs are relatively low, while benefits — savings in time, fuel, and operating costs — are large.

Signal timing improvements are also popular with the public. Traffic flows can be upgraded 24 hours per day, 7 days per week. Traveling within urban areas is faster and easier for everyone, whether driver or passenger, and whether riding in a car, truck, or bus. Tax dollars are spent on a project that benefits everyone.

Improved traffic flow provides motorists with benefits worth from 10 to 30 times the costs of optimizing signal timing.

FHWA began its promotional effort, the National Signal Timing Optimization Project, with three objectives:

- To establish credible data on the effectiveness of signal timing optimization;
- To make signal timing optimization projects easier to accomplish;
- To define the resources, in terms of cost, staffing levels, computer hardware and software, etc., required to undertake a signal timing optimization project. This would allow municipal administrators and traffic engineers to budget realistically for local projects.

To accomplish these objectives, FHWA undertook the development of TRANSYT-7F. The acronym TRANSYT stands for TRAffic Network StudY Tool. The TRANSYT computer program was developed in the United Kingdom to enable traffic engineers to optimize their coordinated traffic signal systems to reduce stops, delays, and fuel consumption. Although the program has been used extensively and successfully in both Europe and the United States, TRANSYT's conventions and terminology are not those normally used in this country. For this reason, FHWA contracted with the University of Florida to develop a version that would be easier to use in the U.S. The resulting version is TRANSYT-7F.

TRANSYT-7F is written in the FORTRAN-IV programming language. The program has been executed successfully on a number of different mainframe computers, including models manufactured by IBM, AmDahl, CDC, Digital, Burroughs, and Honeywell. The program is fairly large, requiring 288K bytes of CPU-addressable memory (172K bytes if the program is overlayed). The run time is approximately proportional to the number of street intersections. On an IBM *3033* computer, for example, networks of 4, 12, and 45 intersections required 5, 22, and 65 seconds of CPU time, respectively.

As part of the development of TRANSYT-7F, FHWA prepared a comprehensive user's manual to serve as an instructional and reference guide. In addition, by the end of next year, FHWA's National Highway Institute will have sponsored 20 presentations of a newly developed training course for those who may want to undertake optimization projects.

One of the more important aspects of developing TRANSYT-7F was the application of the program in a variety of cities across the country. The purpose of this effort was to evaluate TRANSYT's effectiveness and to determine the resources that the using cities had to commit to it. The cities were selected to represent a range of geographical locations, populations, number of intersections to be retimed, types of networks, and ages of existing signal timing plans. One of the reasons for the evaluation was to discover whether any city, regardless of size, could undertake and successfully complete a signal timing optimization project using the TRANSYT-7F computer program.

Eleven cities were selected to participate in the National Signal Timing Optimization Project:

- Charlestown, South Carolina;
- Denver, Colorado;
- Des Moines, Iowa;
- Fort Wayne, Indiana;
- Gainesville, Florida;
- Milwaukee, Wisconsin;
- Nashville, Tennessee;
- Portland, Oregon;
- Pawtucket, Rhode Island;
- San Francisco, California;
- Syracuse, New York.

These cities contracted with FHWA to undertake a project using TRANSYT-7F to optimize the signal timing in a portion of their street network, to evaluate the ef-

Average annual improvement per intersection

City	Delay reduction (Vehicle-hours)	Reduction in total number of stops	Fuel savings (Gallons)	Total dollar savings[1]
Charlestown, SC	3,187	437,600	4,345	$13,586
Denver, CO	74,311	−130,439	31,415	74,598
Des Moines, IA	1,915	238,542	2,926	8,101
Fort Wayne, IN	1,499	438,716	3,681	12,339
Gainesville, FL	21,627	−40,091	9,436	23,935
Milwaukee, WI	4,830	413,788	6,126	17,030
Nashville, TN	20,268	1,129,740	21,012	53,266
Pawtucket, RI	26,345	468,857	14,578	38,688
Portland, OR	3,667	382,554	4,351	12,846
San Francisco, CA	36,377	1,007,032	23,987	67,308
Syracuse, NY	6,428	272,901	4,841	13,909
Average	15,470	455,921	10,524	28,695

(1) Total of fuel savings and reduction in costs due to stops and delays

fectiveness of the newly optimized signal timing plans, and to determine the resources required to conduct the project.

City personnel attended one of four pilot TRANSYT-7F training courses. They collected data from their own networks during the fall of 1980, then coded it and ran the computer programs in the spring of 1981. That summer, the optimized signal timing plans were installed and evaluated. Each city retimed from 23 to 81 intersections, with an average for the 11 cities of 46 intersections.

Local personnel accomplished all of the work. They worked with the TRANSYT-7 F program on city, county, state, and privately operated computers. They kept very detailed records of the resources required for each project task.

The total cost for each project city averaged $20,970. This represented 1714 person-hours or 214 person-days.

The cost to retime each signal averaged $456. This cost includes collecting and coding the necessary data, running the TRANSYT-7F program, analyzing the output, installing the new timing, and fine tuning the new signal timing plans on the street. It does not include project overhead and evaluation.

The labor required to retime each signal averaged approximately 40 hours. About one-half of this requirement was for professional time; the remainder was largely for the time of engineering or maintenance technicians.

The first-time use of TRANSYT-7F to retime traffic signals requires a fairly extensive learning process. Subsequent projects should involve substantially less effort. Training requirements, for example, will be greatly reduced, and data coding much smoother with repetition.

FHWA estimates that the total level of effort for subsequent projects would be from 25 to 30 percent lower than for the first use of TRANSYT-7F. This would reduce overall cost per intersection from $456 to $335, and the total project cost for a 46-intersection network from $20,970 to $15,400. This estimate has been confirmed by several project cities that subsequently performed additional optimization work.

The cities report that their TRANSYT-7F projects accomplished what they were intended to do. At the average project intersection, 455,921 vehicle stops per year were eliminated, 15,470 vehicle-hours of delay were avoided, and 10,524 gallons of fuel were saved.

At a conservative estimate of $0.50 per vehicle-hour for avoided delay—a savings of $0.014 for every stop eliminated—and a fuel cost of $1.35 per gallon, the equivalent total annual benefit averaged $28,695 per intersection. With an average cost per intersection of $456, the benefit/cost ratio for the first year alone was an impressive 63 to one. Subsequent years' savings would make the ratio be even more attractive. If the savings attributable to lowered fuel consumption alone are calculated, the benefit/cost ratio is still a noteworthy 31 to one.

In some cases, improvements predicted by TRANSYT-7F were overly optimistic, particularly when high degrees of traffic saturation were eliminated by signal timing optimization. Eliminating these optimistic results and making all other assumptions as conservative as possible, benefit/cost ratios still range from a minimum of 10 to 1 for a first-time effort that allows for fuel savings only, to 30 to 1 for subsequent projects that allow for savings in both fuel and vehicle stops eliminated.

To verify the reductions in travel time, the cities performed limited floating-vehicle travel-time studies. With only two exceptions, travel times were improved in every city and during every time of day tested. Travel time improvements averaged 8.5 percent, but ranged as high as 31 percent.

With an average 8.5 percent improvement in travel time and an average 12.5 percent reduction in fuel consumption in networks whose traffic signal timing has been optimized, the project has proven highly successful. Moreover, TRANSYT-7F was demonstrated to be a very valuable tool for developing optimal signal timing plans. All of the project cities have plans to continue to use the program as personnel time is available.

In the process of conducting their projects, the cities discovered other deficiencies in their systems. Correcting these problems — bad signal interconnect cable, malfunctioning signal controllers, incorrect settings on some controllers, and the need for additional signal timing plans—provides additional benefits not directly related to the use of the TRANSYT-7F program.

A number of cities reported favorable media coverage of their projects. In several, positive feedback also came from individual citizens. Signal timing improvements proved to be a popular and highly visible service of local government.

Through its regional and divisional offices, FHWA is promoting and supporting signal timing optimization projects. The Systems and Software Support Team of the Office of Traffic Operations in Washington provides the following services:

- Maintenance and distribution of the TRANSYT-7F program and User's Manual;
- Training in the use of TRANSYT-7F to conduct timing optimization projects;
- Technical assistance in the use of the program.

Information about any aspect of the program may be obtained from the Chief of the Systems and Software Support Team, Federal Highway Administration, Office of Traffic Operations (HTO-1), Washington, D.C. 20590, or from any FHWA field office. In addition, several states, including California, Missouri, and Texas, have developed their own programs to provide continuing technical assistance to localities using TRANSYT-7F.

Based on the findings of the trial program and the experiences of the cities involved in it, any jurisdiction with more than a few traffic signals would have much to gain in undertaking a signal timing optimization program. Such a program would provide the motoring public with major dollar savings, would gain goodwill for the local government, and would satisfy national goals. . . and all at low cost. **ACC**

Municipal Cost Indexes

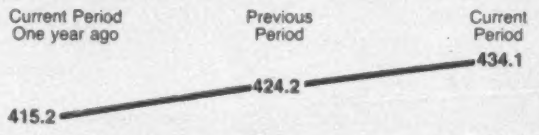
Cost Index Figures of the Month, showing 30-day, 12-month changes (1967 = 100)

ACC MUNICIPAL COST INDEX 313.2 +0.1% +4.6%

Consumer Price Index	293.3	0.2%	5.0%
ACC Construction Cost Index	346.8	0.1	6.3
ACC Construction Materials	308.3	0	2.0
ACC Motorized Equipment	287.9	(2.0)	4.1
ACC Energy: Fuels and Power	908.6	(2.7)	5.0
ACC Consumable Supplies	299.5	0.3	2.8
Producer Price Index	281.4	(0.4)	3.6

MUNICIPAL TREND TO WATCH

Receipts, Billions of Dollars



Current Reference Period: **Second Quarter 1982**

Seasonally adjusted annual rate

CAPITAL EQUIPMENT 279.5 −0.7% +5.4%

Agricultural Machinery & Equip.	313.6	0.7%	7.1%
Air Conditioners (12/77 = 100)	135.5	0	3.3
Construction Machinery & Equip.	347.5	0.3	6.4
Electric Motors	290.8	0.7	0.8
Environmental Controls (6/80-100	117.0	2.0	5.1
Fans and Blowers (Ex. Portable)	336.1	0.5	2.3
Generators and Generator Sets	344.6	0.1	6.7
Heating Equipment	239.3	0.3	4.7
Industrial Material Handling Equip	285.8	0	1.3
Integrating & Measuring Inst.	213.2	0	5.6
Internal Combustion Engines	334.4	0.9%	6.9%
Motor Trucks, Light	256.7	(3.5)	10.6
Motor Trucks, Heavy	289.3	(4.1)	(0.7)
Office Machines	152.5	0.1	2.3
Passenger Cars	201.0	(7.0)	2.5
Photographic Equipment	131.2	0.7	1.2
Pumps, Compressors & Equipment	348.0	0.1	5.3
Railroad Equipment	354.7	0	4.7
Refrig. Compressors (12/77 = 100)	131.2	0	1.0
Switchgear, Switchboard Equip.	260.2	0	3.1

INDUSTRIAL COMMODITIES 316.0 −0.1% +0.4%

Abrasive Products	298.4	0%	6.5%
Apparel	193.5	0	2.9
Asphalt Roofing	400.2	2.0	(0.3)
Building Paper and Board	242.8	(0.4)	3.7
Coal	541.4	0.4	6.1
Commercial Furniture	278.6	0.2	6.5
Concrete Products	298.6	0.1	1.9
Diesel Fuel (2/72 = 100)	782.5	(1.6)	(6.8)
Drugs and Pharmaceuticals	—	—	—
Electric Lamps/Bulbs	289.9	1.6	4.7
Electric Power	415.4	0	8.2
Electronic Components	176.4	0.3	3.3
Fabricated Structural Metal	304.2	(0.1)	1.4
Finished Lubricants	351.6	0.1	1.4
Finished Steel Products	348.4	(0.1)	0.9
Flat Glass	221.1	(2.2)	1.3
Floor Coverings	180.3	0.5	(0.8)
Footwear	248.2	0.4	2.2
Footwear, Rubber	225.9	(0.4)	2.6
Foundry Products	344.4	(0.3)	3.1
Fuel Oil, No. 2 (2/73 = 100)	823.5	(1.7)	(5.8)
Gasoline	686.7	(1.2)	(5.2)
Glass Containers	357.9	0.2	6.7
Gypsum Products	253.9	0	0.4
Hardware	280.4	0	4.7
Industrial Chemicals	349.3	(0.1)	(6.1)
Kerosene (2/73 = 100)	788.3	(2.8)	(3.7)
Lumber, Hardwood	265.1	0.1	2.5
Lumber, Softwood	321.4	(0.6)%	(4.1)%
Millwork	279.5	(0.2)	3.0
Mixed Fertilizers	269.3	(0.6)	1.7
Motor Vehicle Parts	351.1	1.9	7.2
Natural Gas	1411.5	2.7	21.4
Nonferrous Wire and Cable	200.5	(0.8)	(3.7)
Paint Materials	303.0	0.2	(1.6)
Paper	286.0	0	0
Pesticides	—	—	—
Photographic Supplies	271.4	0.3	1.5
Plastic Constr. Prod. (12/69 = 100)	148.8	0.6	(5.0)
Plastic Film (12/70 = 100)	213.3	0	3.0
Plumbing Fixtures & Brass Fittings	277.0	0.8	2.0
Plywood	228.4	(0.4)	(5.1)
Portland Cement	334.6	(0.3)	0.8
Prepared Paint	265.1	0	5.7
Refractories	341.3	0	11.1
Residual Fuel	1120.7	(10.3)	(6.0)
Sand, Gravel & Crushed Stone	283.0	(0.1)	7.3
Sanitary Papers & Health Prod.	355.4	0.2	2.1
Soaps & Synthetic Detergents	253.0	0	4.8
Sporting Goods	209.6	0.1	5.4
Structural Clay Products	259.5	0.3	1.6
Tires and Tubes	255.7	(0.9)	(0.3)
Tractor Parts	232.1	(0.1)	8.7
Transformers & Power Regulators	222.5	(0.9)	4.2
Valves & Fittings	323.1	(0.1)	2.0
Wiring Devices	325.7	0.4	5.5

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ACAQ13 MF2UB141C 00 8008
SUSAN GARNER
SRI ACCUIS/CONGRSNL INFO SV
4520 EAST-WEST HGWY STE 800
BATHESDAUN MD 20814

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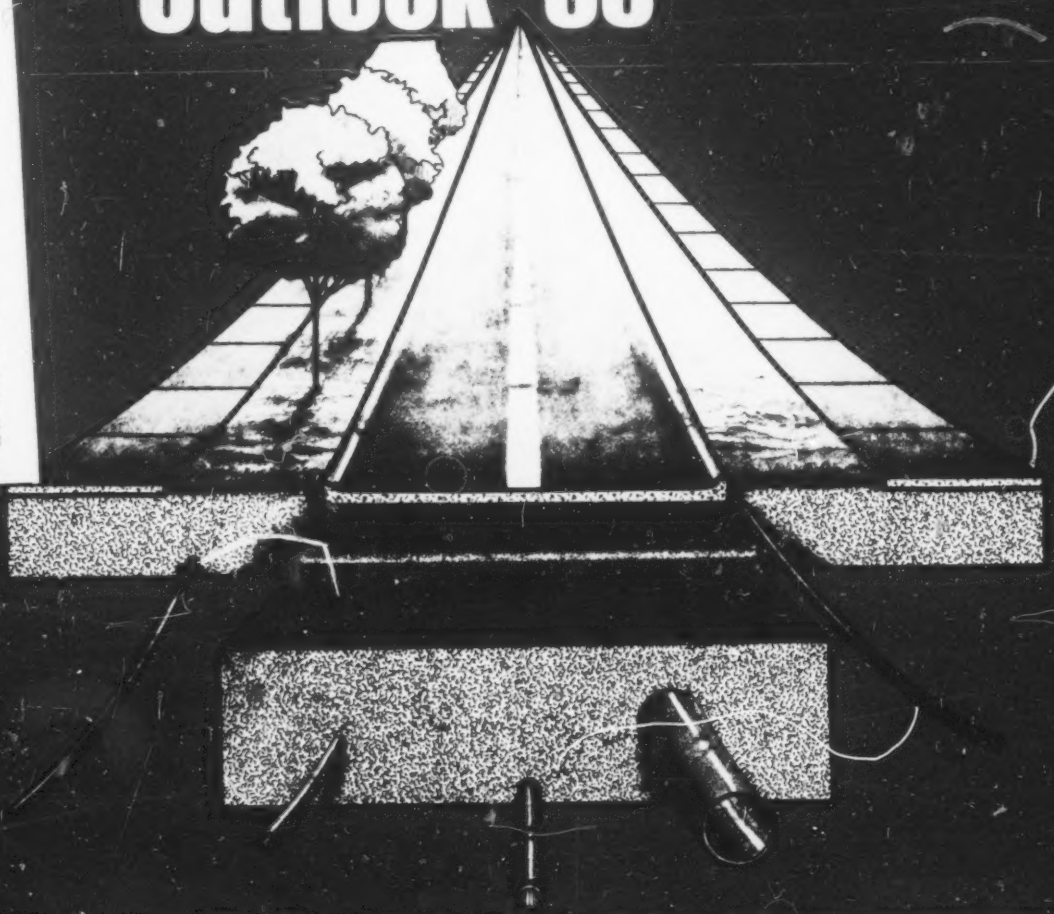

Gearing Up For Infrastructure Preservation

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William L. Forestell, editor-in-chief
Tel: 413/499-2550
Gary M. Chamberlain, senior editor
John P. O'Connor, engineering edito:
John Foster, senior editor
Martha Eischen, computer talk
Kathleen Richards, editorial assistant
Susan O'Connor, production manager
Gertrude E. Bauer, circulation manager
June MacLeod, inquiries manager
Valerie Bassett, art production assistant
Marianne Faybik, market research director

Russell Gilchrist, publisher

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The year starts off with inflation deflated.

On the cover: The artwork symbolizing "infrastructure" was designed by Adela Plonczynski for the cover of the City of Milwaukee's 1982-1987 capital program report. The representation is of a typical street, sewer, water and communications system for a low-density residential application in that city.

Outlook '83

As cities gear up for infrastructure

An exclusive nationwide survey of public works professionals finds that some pessimism may be justified, but not all communities are in fiscal trouble. Some administrators even look forward to the challenge of doing more with less, again.

"In our area, it appears to be turning around somewhat, and 1983 should be better than 1982."

That comment from J. W. Ivey, County Engineer for Columbia County, Georgia, was not the only optimistic response to an *ACC* survey of 1983 municipal budget expectations (his budget went up six percent), but there were fewer optimists than pessimists among those surveyed, to be sure.

More typical of the comments we received were those of Allen Bell, Assistant Director of Public Works in Las Vegas, Nevada, and Leslie Bland, Director of Public Works in Fenton, Michigan. Said Bell: "We are restructuring to handle increasing workloads with decreased capital resources." DPW Director Bland voiced similar concerns, saying, "We will be doing less service in the community due to cutbacks and employee layoffs and will be increasing service fees to cover additional costs."

Our survey was sent to some 128 local government public works officials — officials responsible for capital project budgeting and maintenance in cities and counties across the country. We received replies from department heads in all parts of the country and from cities of under 10,000 population to 1,000,000 and more. What we were told was that money for infrastructure rehabilitation and preservation will be tight in 1983.

Some 81 percent of the cities responding to the survey reported that there would be either "no change" (for 23% of the respondents) or an increase (58% of the respondents) in their overall general revenue budget for 1983. Capital budgets saw a less positive trend with only 59 percent reporting either "no change" (36%) or an increase (23%) over 1982. However, maintenance budgets (as measured by moneys set aside for public works department operations) were generally

preservation...

up: 47 percent of the respondents reported an increased DPW budget in 1983 while 29 percent left that department's budget unchanged from 1982.

Municipalities in the Northeast (comprising the states of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, and Pennsylvania) showed the greatest tendency towards increasing general spending levels in 1983, with 88 percent of the respondents from this area reporting increases ranging from five to 10 percent.

However, some 50 percent of those same communities had cut their capital budgets, and while the remainder had left their 1983 capital budgets unchanged from 1982 figures, none of the respondents from this region reported an increase in this infrastructure-oriented area. Fully 75 percent of these Northeastern communities either increased or left unchanged their maintenance authorizations.

In the North Central region covered by our survey (Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, Kansas, Nebraska, North and South Dakota), states hard hit by the present recession, only 54 percent of the responding officials reported an increase in overall spending levels for 1983. (Thirty-one percent had level funded 1983 general revenue budgets.) Yet, in this industrial heartland, 75 percent of the respondents reported either "no change" or an increase in capital expenditure levels for 1983. Communities in this region showed the greatest determination to do something about their physical plant, with some 33 percent of them indicating they would increase such spending this year.

Reports from the Southern region (Texas, Oklahoma, Louisiana, Arkansas, Kentucky, Tennessee, Mississippi, Alabama, Georgia, South Carolina, North Carolina, Virginia, West Virginia, Maryland, Delaware, and Florida) showed the least inclination to increase either overall spending levels or capital budgets for 1983. Only 45 percent of these communities expect to increase their total budget authorization levels this year, and only 27 percent reported increasing capital budgets for 1983. Fully 55 percent of the respondents from this region reported that they will cut capital spending this year. Maintenance budgets for commu-

nities in these Sunbelt region states split about even: 45 percent will be up in 1983 and 45 percent will be lower.

In the West (California, Washington, Oregon, Idaho, Montana, Wyoming, Nevada, Utah, Colorado, Arizona, and New Mexico (We did not hear from Alaska or Hawaii.)), expenditure trends generally fell into line with the national averages. Fifty-five percent of the respondents reported increases in total authorizations for 1983, 23 percent upped capital budgets, and 38 percent left capital spending levels unchanged from those of 1982. Maintenance budgets for communities in this region generally stayed the same or increased over 1982 levels, however, as 46 percent reported more money for DPW operations and 31 percent said their departments had been level-funded.

On comparing expenditure levels with population, we found that fewer communities on both the top end of the scale (greater than 250,000) and at the bottom (less than 10,000) were expecting to spend more in 1983. Only 60 percent of the respondents with populations less than 10,000 reported either "no change" or an increase in overall spending for 1983, while two-thirds advised that both

National policy needed to prevent disaster

The frightening state of public infrastructure today demands a coordinated national effort to protect the country's physical plant. But is better federal management the answer?

James J. Howard

Representative Howard (D-New Jersey) is the Chairman of the House Committee on Public Works and Transportation. His committee is currently considering legislation which would establish a national Capital Budget at the federal level to give Congress and the Executive Branch better management control over public works dollars.

"Infrastructure" — that's a terrible word. In plain language, "infrastructure" is shorthand for the incredibly complex substructure of steel and concrete, of brick and mortar, on which our national economy rests — the public facilities built up over two centuries by the toil and treasure of the American people.

Without that infrastructure, in sound and vigorous condition, our free enterprise system would simply cease to exist. Because all of our commerce and industry, all of our agriculture, all the thousands upon thousands of services that make our cities livable depend absolutely on the soundness of our public works.

We're talking about the bridges and tunnels that make it possible for New Jerseyites to cross the Hudson River without getting their feet wet. We're talking about the water and sewer systems that maintain life in our urban centers, large and small; the network of streets, roads, and superhighways that link town and countryside; our mass transit and commercial aviation systems, our seaports and inland waterways; the high dams that power and irrigate vast sections of our country. Those are our public works. Together, they make up this infrastructure, this foundation.

And the state of that infrastructure today? In one word: frightening.

Like London Bridge in the old nursery jingle, America today is falling down.

That is not a wild exaggeration. I assure you it is literally true. Just take a look at what's happening all [illegible]erica today. With very few [illegible] our central cities are in an [illegible]te of decay, choked with traffic, saddled with rundown, inadequate public transportation. Miles and miles of our urban streets are obstacle courses for the unwary motorist.

And if you think the streets are bad, what is happening underneath is many times worse. In the East, many of our underground water and sewer lines are more than a hundred years old. Leaking at every joint, they constitute a deadly menace to our health and safety.

The roads and highway bridges that we have built over the years at enormous cost are breaking down faster than we can fix them or replace them. We have invested billions of dollars in what used to be the finest highway system to be found anywhere on earth. And yet, at this very moment, nearly 26,000 miles of Interstate, arterial, and collector highways are in immediate need of major repair or reconstruction. On the Federal-aid system alone there are more than 105,000 bridges that would be closed to traffic right now if alternate crossings were available.

How did we get into this fix?

Our fundamental difficulty has been that this infrastructure of ours, these essential public works, have been taken for granted. They have no constituency as such. If your town or mine lays off 50 policemen or schoolteachers or firemen as an economy measure, there's an immediate public outcry and the Mayor gets no peace until another way is found to save money. But it's mighty hard to organize a march on City Hall for a million dollars worth of preventive maintenance on the town waterworks — until the faucets run dry.

"Management" and "investment" are the key words. Because our bridges and highways, our water and sewer systems, our transit lines, our airports and seaports, and our inland waterways are *investments* in the health and well-being of this country of ours, and if we don't start protecting those investments through wiser management we can forget about rebuilding the economy, or for that matter, even maintaining the sorry state in which it now finds itself.

All of us who hold public office would be abdicating our responsibilities, betraying the public trust, and abandoning reason itself if we stand idly by, if we persist in a do-nothing or, at best, a haphazard course. We are courting certain disaster if we do not pursue and achieve a national public works policy. ■

capital spending and maintenance budgets would be held at about the same levels as 1982. However, communities in this size range appeared to be putting greater emphasis on maintaining existing facilities as opposed to adding new physical plant, as evidenced by the number of respondents increasing DPW budgets (50%) and the number level-funding capital budgets (50%).

Communities in the 10,000 to 25,000 size range appeared to be opting for increasing general budgets and maintenance budgets while joining their smaller cousins in level-funding capital budgets at 1982 levels. Some two-thirds of these jurisdictions were reporting increased overall spending for 1983, and 83 percent reported increasing their public works budgets. Nearly two-thirds of these respondents reported level-funding capital spending, with the remainder reporting increases in this functional area.

In the 25,000 to 100,000 population range, 65 percent of the responding communities reported increases in general expenditures, and 55 percent reported upping maintenance budgets. In this same size range, however, 47 percent of the respondents reported cuts in their capital budgets for 1983.

In cities from 100,000 to 250,000 in population, the main target for the budget cutter's axe appeared to be the capital budget: some 62 percent of the communities in this size range reported cuts in this line item for 1983. Only 57 percent of these communities found it possible to raise their total budget levels, and only 13 percent were able to give more money to maintenance this year.

In the largest communities, those greater than 250,000 in size, level-funding was the rule. Sixty percent level-funded overall spending at 1982 levels; 40 percent held the line on capital budgets (another 40 percent cut this budget item); and 40 percent turned thumbs down on maintenance budget increases for this year.

The general economy was seen as the most threatening factor for 1983. Sixty percent of the respondents thought that it would negatively affect them, while 20 percent thought that the effect would be positive, and an equal number thought that their operations would not be affected by the overall economy. Regionally, the effects of the economy were most likely to be seen as negative in the north central states.

Municipal administrators split relatively when queried about the effect of public attitudes on their operations. One-third said that their activities will be unaffected by public attitudes in

Which Cities Are Spending More

By Population (% of Respondents)

City Size	Total Budget	Capital Budget	Maintenance
Less than 10,000	40%	17%	50%
10,000 to 25,000	67	33	83
25,000 to 100,000	65	32	55
100,000 to 250,000	57	0	13
Greater than 250,000	40	20	40

By Region (% of Respondents)

Northeast	88%	0%	50%
North Central	54	33	54
South	45	27	45
West	55	23	50

Which Cities Are Level-Funding

By Population (% of Respondents)

City Size	Total Budget	Capital Budget	Maintenance
Less than 10,000	20%	50%	17%
10,000 to 25,000	33	67	16
25,000 to 100,000	10	21	20
100,000 to 250,000	29	38	50
Greater than 250,000	60	40	40

By Region (% of Respondents)

Northeast	0%	50%	25%
North Central	31	42	38
South	27	18	9
West	27	38	25

Outlook '83

1983. Slightly more — 38 percent — said that public attitudes will impact on them negatively, and slightly fewer — 29 percent — said that the impact will be positive. The consensus seems to be that the public's only interest is in lower taxes and more and better services.

New Federalism, the Reagan administration program that has received a lot of negative publicity because of fears that it would overburden state and local governments, is not considered a threat by most public works officials surveyed. Nearly half of them thought that New Federalism would not affect their operation at all, while 14 percent thought that it would have a positive effect.

Comments by the survey respondents indicated that their primary concerns in 1983 will be accomplishing their assigned tasks within the resources available. Some reported increased responsibilities, primarily in the streets and solid wastes areas, and insufficient additional funding. Others are trying to maintain the same levels of services with reduced funding. Still others have had to bite the bullet and cut services.

In response to pressures to improve productivity, some administrators are re-

How one city takes infrastructure preservation in

A well-organized six-year capital budgeting program helps the City of Milwaukee get control of its physical plant needs. The early appraisal of anticipated expenditures, ability to pay, and levels of accomplishment help make the city's big job manageable.

Over the last few years the emphasis in most Northern and Snowbelt municipal spending programs has shifted from planning and expansion of public works, to maintenance of the existing public infrastructure.

Milwaukee, like other older Northern cities has faced the tough task of budgeting its capital program.

To anticipate spending needs and set budgets, the city established a Captial Improvements Committee chaired by its commissioner of public works. The committee is charged with annually filing a Six-Year Capital Improvements Program consisting of an annual budget and the committee's recommendations for capital expenditures during the future five-year period.

The Six Year Capital Improvements Program is revised each year. Public officials, city agencies, bureaus and departments propose projects for inclusion, deletion, or scheduling changes. The Committee reviews and places priorities on the various proposals, taking into account such factors as the cost of the project and the effect on property values in the city; the effect of the proposal on the social and economic prosperity of the city; the extent to which the proposed project is necessary to maintain existing service levels; and the relationship of the proposal to the city's Comprehensive Plan (with emphasis on the Six Year Capital Improvements Program).

After the Committee completes its review, public hearings are held, and a preliminary Six Year Program is established. The initial year of the preliminary Six Year Program becomes the requested Capital Budget. After the Common Council and the Mayor approve the Budget, the approved Capital Budget becomes the first year of the Six Year Program. The Capital Improvements Committee then prepares a new Six Year Capital Improvements Program, which is submitted to the Common Council for its information.

According to committee chairman Herbert Goetsch, "The maintenance of the physical plant (or preservation of the infrastructure) has in the last several years become the dominant feature of capital improvements programming in Milwaukee . . . About 70 percent of that portion of the 1982 to 1987 capital program which is financed by local revenues (that is, excluding State and Federal grants), is devoted to infrastructure preservation."

Milwaukee's Six Year Capital Improvements budget encompasses such diverse areas as streets, alleys, sewers, water distribution, public buildings, preventive maintenance, street lighting, traffic controls, communication and underground conduit systems, urban forestry, and recreational facilities. For 1982, Milwaukee's total capital budget was $78 million. For the Six Years from 1982 to 1987 the Committee has recommended a budget of $572 million.

While that sounds like a pretty good piece of change, the city has quite a jo. to do.

For 1982, the budget for streets in Milwaukee was more than $15 million, which was primarily designated for street resurfacing and reconstruction. As a result of anticipated cuts in Federal aid to local streets and future inflation, the committee recommended the expenditure of $91.6 million for streets between 1982 and 1987—up $25.7 million from the 1981 to 1986 Program.

The City of Milwaukee has jurisdiction over 231 bridges, viaducts, and pedestrian overpasses. The Bureau of Bridges and Public Buildings is responsible for the operation, maintenance, repair and replacement of these structures. The 1982 to 1987 program for bridges is $76.4 million or about $13 million a year. The Six Year plan allows for systematic scheduled maintenance and replacement of defec-

organizing departments to make more efficient use of the assets available to them. Even more public works departments — a full ten percent of them — anticipate computerizing some or all of their functions in the coming year.

Perhaps the most interesting finding of the survey was the positive reaction public works officials generally have in the face of adversity. While all of the pressures to meet community needs with inadequate resources should cause officials to find, in the words of one respondent, "municipal service less satisfying," many officials reacted the opposite.

Gary Martin, city engineer in Dothan, Alabama, says, "The economic situation will be beneficial because it will force better efficiency and a reduction in waste in the operations of local government."

Larry Thomas, director of public works in Stanford, North Carolina, is reorganizing his leaf-and-limb pickup and his street services. Thomas predicts "a good year, with increased pressures to become more efficient."

The most outspoken optimist was John Bradley, public services director in Los Alamos, New Mexico. About 1983, Bradley said: "Looks exciting to me." **ACC**

stride

Since the early 1970's, the focus of (Milwaukee's) Six Year (Capital Improvements) Program has been shifting away from planning for the extension of public facilities to serve new development to the upgrading and expansion of public facilities to serve the existing population, and finally, to maintain the existing physical plant.

Herbert A. Goetsch*
Director of Public Works and
Chairman, Capital Improvements Committee
City of Milwaukee, Wisconsin

*Mr. Goetsch retired from the City of Milwaukee this month.

tive bridges.

The sewer system in Milwaukee consists of 2,420 miles of storm, sanitary, and combined sewers and related appurtenances. The Bureau of Engineers maintains a computerized inventory of the age, length, capacity, location and replacement costs of the entire sewer system. From this inventory, a "survivor curve" has been developed showing annual replacement needs based on estimates of the average life of sewers.

The Bureau of Street and Sewer Maintenance has a 1982 budget of $11.4 million. That amount provided funding for some 6,000 tons of bituminous concrete for temporary repairs of potholes and sidewalks; preventive maintenance for the street and alley systems (approximately 14 percent of the city's roadways are crack-filled annually); permanent repairs to about 350,000 square yards of street pavement; a pavement seal coating for about 18 percent of the city's total macadam and double seal pavements; cleaning of 4.3 million linear feet of sewers (about 34 percent of the system; repairs to about 2,000 catch basins, storm inlets, and manholes; and examination of 1.3 million feet of sewers.

The City of Milwaukee owns the Milwaukee Water Works, and runs it as an enterprise fund financed by user charges. The city currently replaces about 2.8 miles of water mains a year. A computerized profile of the water distribution system has established a priority system for replacing pipe sections.

The 1982 to 1987 Capital Improvements Program also includes $21.4 million for the construction and renovation of buildings. The city owns 217 buildings including major office buildings, shops and repair garages, and field service centers.

The Bureau of Traffic Engineering and Electrical Services is responsible for both street lighting and traffic control facilities.

The 1982 to 1987 city budget includes more than $13 million for street lighting. The city's street lighting system includes over 60,000 street light lamps. Over the next few years the lighting program will be expanded into areas currently without street lighting, and the entire street lighting system will be upgraded to more efficient vapor lamps.

The Bureau also plans, designs and maintains the city's signs, signals, and roadway markings. The 1982 to 1987 Capital Improvements Program for traffic control is $3.8 million. And if existing Federally-aided traffic control programs remain intact, the city could anticipate an additional $3.7 million, increasing the program to $7.5 million. Focus of the current traffic program is modernization of outdated equipment.

The Bureau of Traffic Engineering and Electrical Services is also responsible for the city's communication system and underground conduit system. The Six Year budget includes $2 million for communications and $4.4 million for installation of underground conduit.

The Bureau of Forestry is responsible for planning, planting, and management of street trees, boulevards, and other green spaces. The bureau is responsible for more than 300,000 trees, municipal properties, and 114 miles of landscaped boulevard medians. Many of the trees, shrubs, and annuals are grown in the city's 150-acre nursery. ■

Municipal Cost Indexes

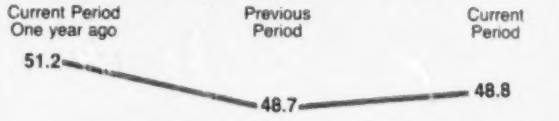
Cost Index Figures of the Month, showing 30-day, 12-month changes (1967 = 100)

ACC MUNICIPAL COST INDEX 313.4 +0.1% +4.1%

Consumer Price Index	294.1	0.3%	5.3%
ACC Construction Cost Index	346.6	(0.1)	4.9
ACC Construction Materials	307.8	(0.2)	2.2
ACC Motorized Equipment	300.2	4.3	6.2
ACC Energy: Fuels and Power	902.1	(0.7)	5.5
ACC Consumable Supplies	299.6	0	2.3
Producer Price Index	283.9	0.5	3.5

MUNICIPAL TREND TO WATCH

Public Construction Put In Place, Billions of Dollars



Current Reference Period: **July 1982**

Seasonally adjusted a nual rate

CAPITAL EQUIPMENT 283.8 +1.6% +4.6%

Agricultural Machinery & Equip.	317.0	1.1%	8.5%
Air Conditioners (12/77 = 100)	135.7	0.1	3.2
Construction Machinery & Equip.	346.6	(0.3)	5.3
Electric Motors	291.2	0.1	2.3
Environmental Controls (6/80 = 100)	119.7	2.3	8.0
Fans and Blowers (Ex. Portable)	336.1	0	2.2
Generators and Generator Sets	344.6	0	2.5
Heating Equipment	238.7	(0.3)	4.5
Industrial Material Handling Equip	285.6	(0.1)	0.1
Integrating & Measuring Inst.	213.7	0.2	4.2
Internal Combustion Engines	334.8	0.1%	7.3%
Motor Trucks, Light	273.9	6.7	2.7
Motor Trucks, Heavy	317.5	9.7	7.5
Office Machines	152.7	0.1	3.1
Passenger Cars	219.6	9.3	2.6
Photographic Equipment	128.6	(2.0)	(0.8)
Pumps, Compressors & Equipment	347.8	(0.1)	0.1
Railroad Equipment	357.5	0.8	3.6
Refrig. Compressors (12/77 = 100)	138.9	5.9	6.9
Switchgear, Switchboard Equip.	260.9	0.3	4.8

INDUSTRIAL COMMODITIES 315.5 −0.2% +0.3%

Abrasive Products	298.4	0%	6.5%
Apparel	193.5	0	3.0
Asphalt Roofing	405.1	1.2	0.9
Building Paper and Board	241.5	(0.5)	3.9
Coal	539.7	(0.3)	5.6
Commercial Furniture	278.8	0.1	6.2
Concrete Products	298.7	0	1.8
Diesel Fuel (2/72 = 100)	782.2	0	(6.8)
Drugs and Pharmaceuticals	214.7	1.0	(3.7)
Electric Lamps/Bulbs	296.8	2.4	6.2
Electric Power	409.1	(1.5)	8.8
Electronic Components	176.5	0.1	3.7
Fabricated Structural Metal	303.7	(0.2)	0.5
Finished Lubricants	351.4	0.9	1.1
Finished Steel Products	349.8	0.4	0.7
Flat Glass	221.1	0	1.2
Floor Coverings	180.3	0	(0.7)
Footwear	249.2	0.4	3.1
Footwear, Rubber	225.9	0	2.4
Foundry Products	346.8	0.7	3.2
Fuel Oil, No. 2 (2/73 = 100)	818.3	(0.6)	(4.3)
Gasoline	674.6	(1.8)	(6.9)
Glass Containers	358.4	0.1	7.0
Gypsum Products	255.1	0.5	1.1
Hardware	280.8	0.1	5.0
Industrial Chemicals	347.6	(0.5)	(5.9)
Kerosene (2/73 = 100)	774.7	(1.7)	(5.2)
Lumber, Hardwood	264.9	(0.1)	2.3
Lumber, Softwood	315.5	(1.8)%	(2.9)%
Millwork	278.6	(0.3)	2.7
Mixed Fertilizers	267.3	(0.7)	1.5
Motor Vehicle Parts	352.3	0.3	7.0
Natural Gas	1399.4	(0.9)	22.3
Nonferrous Wire and Cable	198.3	1.1	(5.3)
Paint Materials	303.0	0	(1.6)
Paper	285.6	(0.1)	(1.0)
Pesticides	467.3	(0.2)	4.6
Photographic Supplies	271.4	0	(1.2)
Plastic Constr. Prod. (12/69 = 100)	147.9	(0.6)	(5.1)
Plastic Film (12/70 = 100)	213.3	0	3.5
Plumbing Fixtures & Brass Fittings	277.8	0.3	1.8
Plywood	224.0	(1.9)	(4.4)
Portland Cement	335.6	0.3	2.6
Prepared Paint	265.1	0	5.6
Refractories	341.3	0	10.5
Residual Fuel	1125.2	0.4	(4.2)
Sand, Gravel & Crushed Stone	283.6	0.2	6.3
Sanitary Papers & Health Prod.	355.2	(0.1)	1.7
Soaps & Synthetic Detergents	253.0	0	5.1
Sporting Goods	223.7	(0.4)	4.7
Structural Clay Products	259.5	1.5	1.5
Tires and Tubes	255.8	0	(0.7)
Tractor Parts	231.9	(0.1)	8.6
Transformers & Power Regulators	220.6	(0.9)	2.9
Valves & Fittings	322.5	(0.2)	2.6
Wiring Devices	326.7	0.3	3.8

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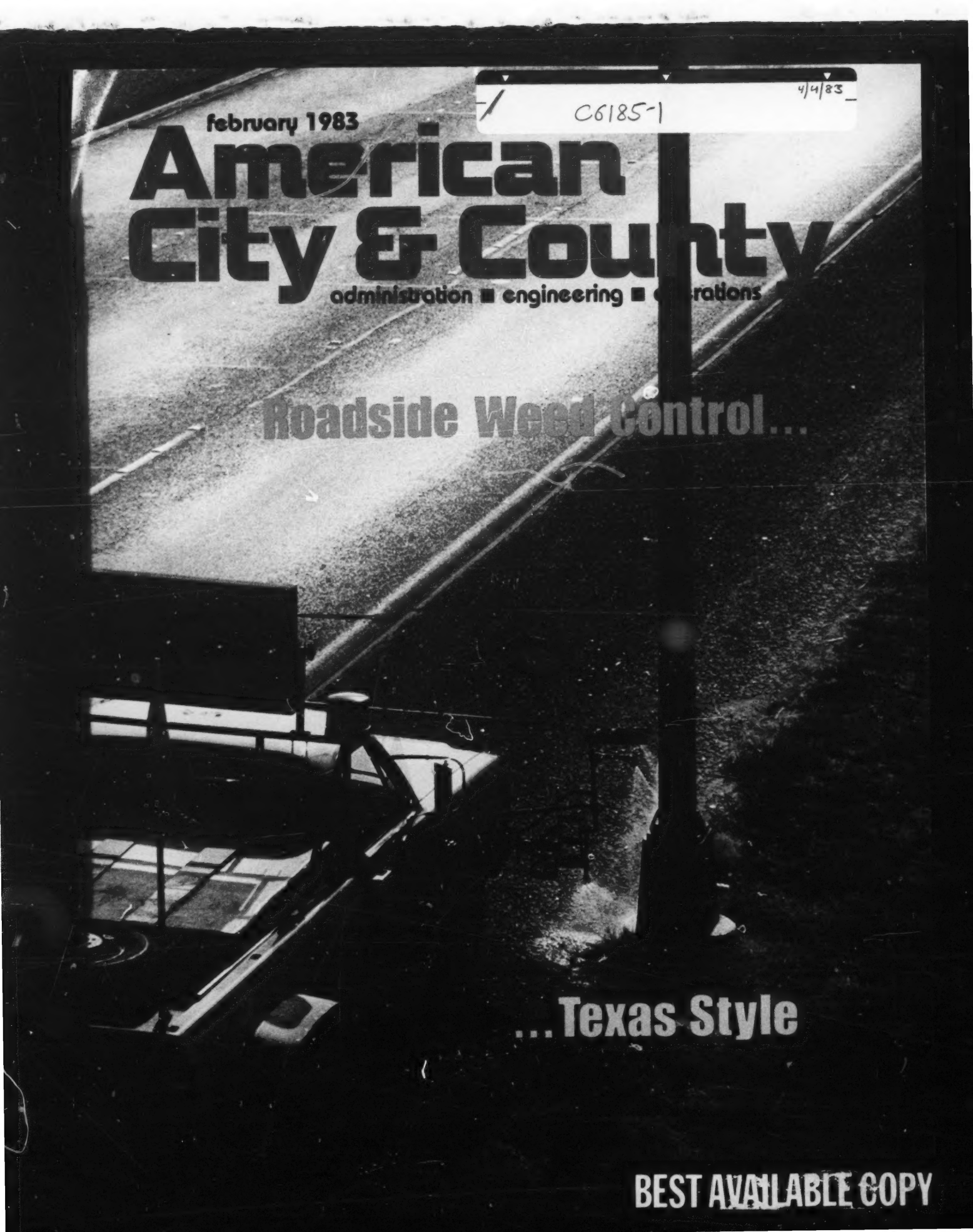
february 1983

American City & County

administration ■ engineering ■ operations

Roadside Weed Control...

...Texas Style



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Berkshire Common, Pittsfield, MA 01201.

William L. Forestell, editor-in-chief
Tel: 413/499-2550
Gary M. Chamberlain, senior editor
John P. O'Connor, engineering editor
John Foster, senior editor
Martha Eischen, computer talk
Kathleen Richards, editorial assistant
Susan O'Connor, production manager
Gertrude E. Bauer, circulation manager
June MacLeod, inquiries manager
Marianne Faybik, market research director

Russell Gilchrist, publisher

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Recessionary pressure still holding prices down.

On the cover: A Texas Department of Transportation weed control vehicle gives a shot of herbicde to another batch of unwanted roadside flora in this photo from Monsanto Corp.

Municipal Cost Indexes

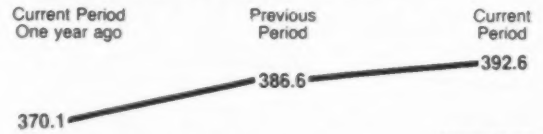
Cost Index Figures of the Month, showing 30-day, 12-month changes (1967 = 100)

ACC MUNICIPAL COST INDEX 313.8 +0.1% +3.4%

Consumer Price Index	293.6	(0.2)%	4.6%
ACC Construction Cost Index	348.2	0.5	4.2
ACC Construction Materials	307.3	(0.2)	2.2
ACC Motorized Equipment	300.4	0.1	5.6
ACC Energy: Fuels and Power	923.2	2.3	7.5
ACC Consumable Supplies	299.1	(0.2)	1.6
Producer Price Index	284.9	0.3	3.7

MUNICIPAL TREND TO WATCH

Purchases of Goods and Services, Billions of Dollars



Current Reference Period: Third Quarter 1982

Seasonally adjusted annual rate

CAPITAL EQUIPMENT 284.0 +0.1% +4.0%

Agricultural Machinery & Equip.	318.1	0.3%	5.8%	Internal Combustion Engines	335.0	0.1%	6.3%
Air Conditioners (12/77 = 100)	136.6	0.7	3.7	Lawnmowers	248.3	(0.7)	8.1
Construction Machinery & Equip.	347.8	0.3	5.5	Motor Trucks, Light	274.0	0	1.6
Electric Motors	293.1	0.7	1.2	Motor Trucks, Heavy	317.4	0	7.6
Environmental Controls (6/80 = 100)	118.1	(1.3)	6.1	Office Machines	153.0	0.2	3.4
Fans and Blowers	336.1	0	2.2	Passenger Cars	218.4	(0.5)	2.0
Generators and Generator Sets	220.6	0	(0.7)	Photographic Equipment	128.6	0	(1.2)
Heating Equipment	238.9	0.1	4.4	Pumps, Compressors & Equipment	348.0	0.1	3.6
Industrial Material Handling Equip	286.3	0.2	0.7	Refrig. Compressors (12/77 = 100)	140.2	0.9	6.9
Integrating & Measuring Inst.	214.9	0.6	5.5	Switchgear, Switchboard Equip.	260.6	(0.1)	2.2

INDUSTRIAL COMMODITIES 315.7 +0.1% +0.4%

Abrasive Products	298.4	0%	4.1%	Lumber, Softwood	313.2	(0.7)%	(1.2)%
Apparel	193.8	0.2	1.6	Millwork	280.3	0.6	3.1
Asphalt Roofing	397.5	(1.9)	(3.1)	Mixed Fertilizers	264.4	(1.1)	(0.9)
Building Paper and Board	240.4	(0.5)	3.6	Motor Vehicle Parts	352.3	0	5.3
Coal	540.3	0.1	5.4	Natural Gas	1469.3	5.0	25.7
Commercial Furniture	279.1	0.1	6.0	Nonferrous Wire and Cable	198.2	(0.1)	(4.2)
Concrete Products	298.1	(0.2)	1.6	Paint Materials	302.3	(0.2)	(1.9)
Diesel Fuel (2/72 = 100)	806.3	3.1	(3.0)	Paper	281.7	(1.4)	(2.0)
Electric Lamps/Bulbs	296.8	0	6.6	Pesticides	467.3	0	1.8
Electric Power	405.2	(1.0)	7.1	Photographic Supplies	271.3	0	1.4
Electronic Components	178.2	1.0	4.4	Plastic Constr. Prod. (12/69 = 100)	148.7	0.5	(2.1)
Fabricated Structural Metal	302.8	(0.3)	(0.1)	Plastic Film (12/70 = 100)	213.0	(0.1)	2.7
Finished Lubricants	351.2	(0.1)	1.0	Plumbing Fixtures & Brass Fittings	278.2	0.1	1.9
Finished Steel Products	349.3	(0.1)	0.2	Plywood	227.8	1.7	(2.4)
Flat Glass	225.3	1.9	3.1	Portland Cement	334.8	(0.2)	1.4
Floor Coverings	180.2	(0.1)	(1.2)	Prepared Paint	265.1	0	4.2
Footwear	249.1	0	3.9	Refractories	337.7	(1.1)	9.3
Footwear, Rubber	225.9	0	2.4	Residual Fuel	1152.8	2.5	(1.8)
Foundry Products	346.1	(0.2)	2.7	Sand, Gravel & Crushed Stone	283.7	0	7.1
Fuel Oil, No. 2 (2/73 = 100)	859.9	5.1	0.9	Sanitary Papers & Health Prod.	364.5	2.6	4.7
Gasoline	665.4	(1.4)	(7.6)	Soaps & Synthetic Detergents	255.6	1.0	3.8
Glass Containers	358.5	0	6.9	Sporting Goods	207.8	0	5.6
Gypsum Products	254.9	(0.1)	1.4	Structural Clay Products	264.3	1.8	3.0
Hardware	280.8	0	3.4	Tires and Tubes	254.8	(0.4)	(0.4)
Hydraulic Power Eq. (12/70 = 100)	247.2	0	8.3	Tractor Parts	232.9	0.4	7.9
Industrial Chemicals	345.8	(0.5)	(4.9)	Transformers & Power Regulators	220.6	0	(0.7)
LP Gas	760.0	5.3	8.0	Valves & Fittings	322.7	0.1	1.7
Lumber, Hardwood	265.3	0.2	2.2	Wiring Devices	326.6	0	3.7

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American City & County

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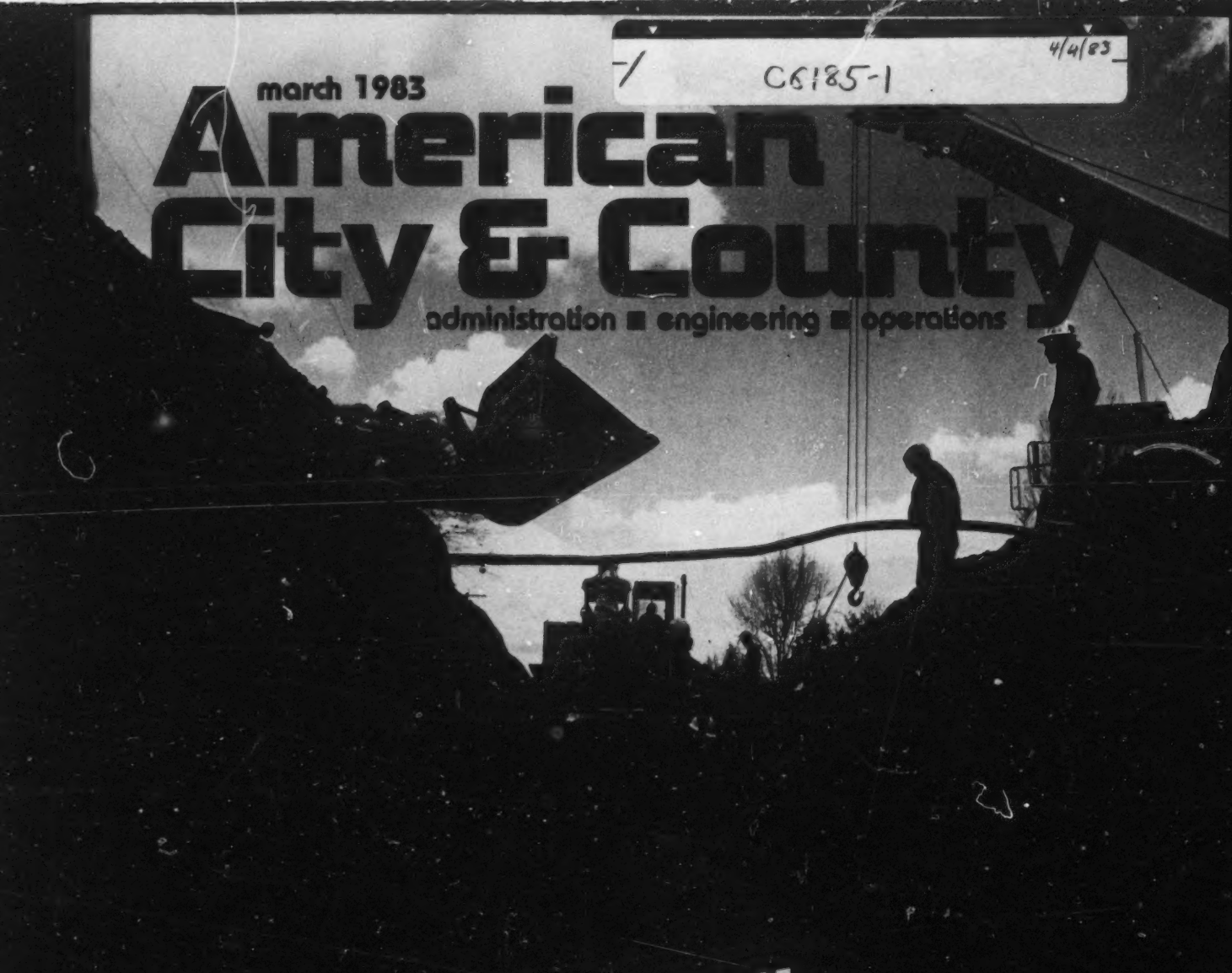

Save Money On Sewer Repairs

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Berkshire Common, Pittsfield, MA 01201.

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Tel: 413/499-2550
Gary M. Chamberlain, senior editor
John P. O'Connor, engineering editor
John Foster, senior editor
Martha Eischen, computer talk
Kathleen Richards, editorial assistant
Susan O'Connor, production manager
Gertrude E. Bauer, circulation manager
June MacLeod, inquiries manager
Marianne Faybik, market research director

Russell Gilchrist, publisher

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Fuel prices dropping fast; MCI leveling off.

On the cover: It may cost less to plan to repair the sewer shown being constructed than to wait until a disasterous collapse occurs, according to the two experts who authored this month's feature, "Take A Hard Look At Sewer Rehab." Photo courtesy of CH2M Hill Engineers.

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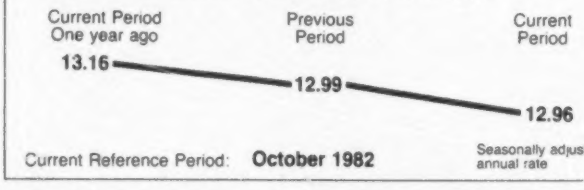
MUNICIPAL TREND TO WATCH

State and Local Government Employment, Millions



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Abrasive Products	298.4	0%	3.8%	Lumber, Softwood	320.6	2.4%	(0.4)%
Apparel	191.7	(1.1)	0.4	Millwork	286.1	2.1	4.5
Asphalt Roofing	395.4	(0.5)	(2.5)	Mixed Fertilizers	263.7	(0.3)	(0.5)
Building Paper and Board	241.4	0.4	4.8	Motor Vehicle Parts	352.7	0.1	5.2
Coal	540.3	0	4.9	Natural Gas	1457.6	(0.8)	20.7
Commercial Furniture	279.0	0	5.7	Nonferrous Wire and Cable	198.1	(0.1)	(3.8)
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Fuel Oil, No. 2 (2/73 = 100)	866.6	0.8	0	Sanitary Papers & Health Prod.	362.6	(0.5)	3.9
Gasoline	654.2	(1.7)	(8.6)	Soaps & Synthetic Detergents	255.6	0	1.7
Glass Containers	358.5	0	6.9	Sporting Goods	208.2	0.2	5.7
Gypsum Products	253.9	(0.4)	1.7	Structural Clay Products	264.3	0	2.6
Hardware	283.5	1.0	4.2	Tires and Tubes	256.2	0.5	0.3
Hydraulic Power Eq. (12/70 = 100)	248.9	0.7	5.7	Tractor Parts	232.6	(0.1)	7.7
Industrial Chemicals	342.9	(0.8)	(5.5)	Transformers & Power Regulators	220.3	(0.1)	(0.8)
LP Gas	743.1	(2.2)	7.0	Valves & Fittings	323.5	0.2	1.5
Lumber, Hardwood	266.1	0.3	2.8	Wiring Devices	327.8	0.4	3.2

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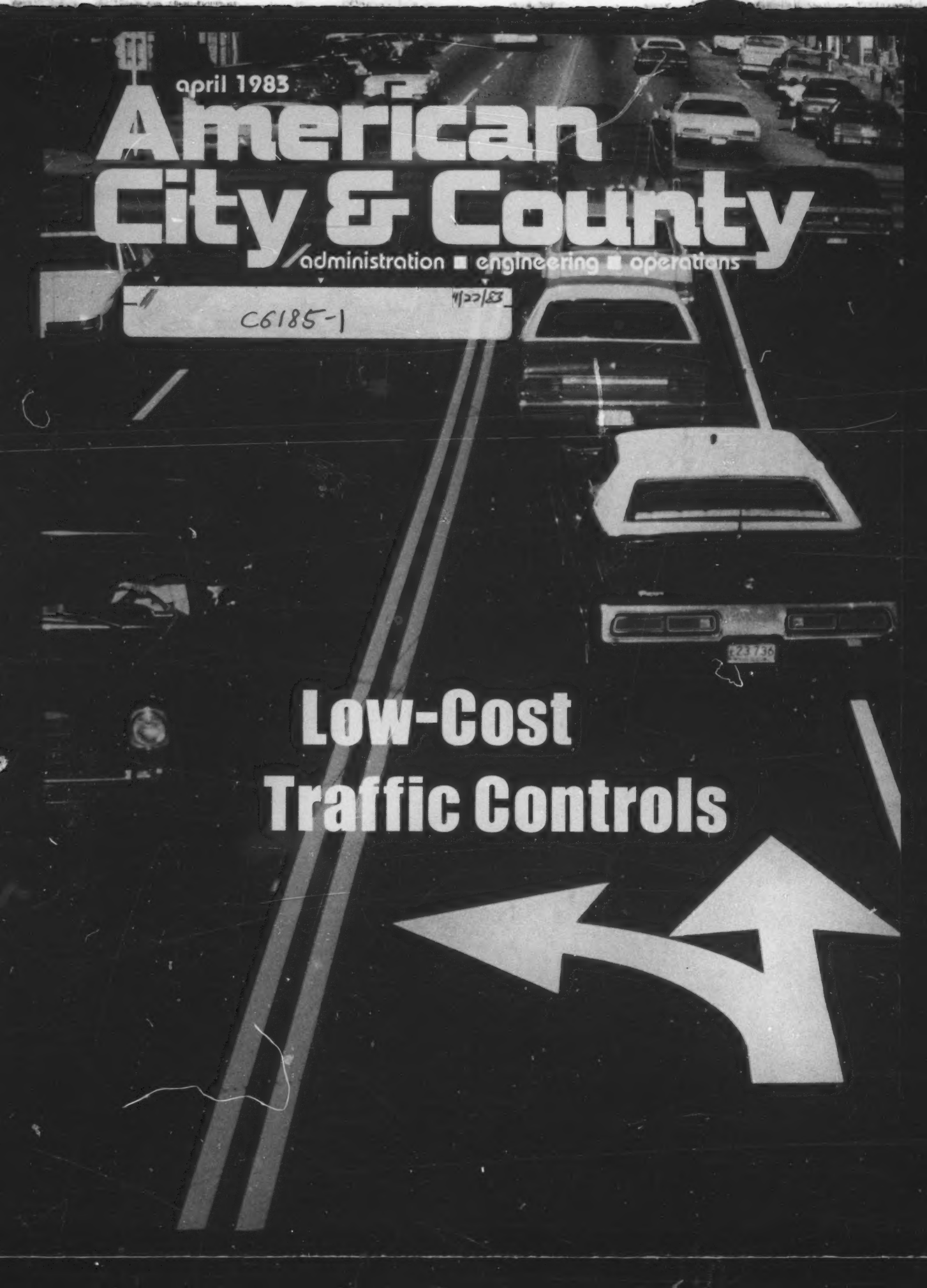
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William L. Forestell, editor-in-chief
Tel: 413 499-2550
Gary M. Chamberlain, senior editor
John P. O'Connor, engineering editor
John Foster, senior editor
Martha Eischen, computer talk
Kathleen Richards, editorial assistant
Susan O'Connor, production manager
Gertrude E. Bauer, circulation manager
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Stability at the three- to four-percent level.

On the cover: Find out if your community can cut its traffic engineering budget in this month's cover story, "A Checklist For Traffic Management." Photo courtesy of 3M Company.

If it doesn't move, paint it

When rallying to the battlecry, "Preserve the infrastructure," it's important to recognize that one of the primary enemies is corrosion, and a first line of defense is protective coatings.

John O'Connor
Engineering Editor

People in every line of work run up against Murphy's Law: "If anything can go wrong, it will." People involved with painting and protective coatings take this law one step further: "No matter what goes wrong, it probably will be covered over to look all right."

But the function of paint is not just to make things look all right for a time. Coatings are applied to protect building materials — particularly steel, the most important structural material — from corrosion.

Local governments own billions of dollars worth of bridges, water tanks, wastewater treatment facilities, and countless other items that must be protected by properly selected and applied coatings. The public works professional has a primary responsibility for ensuring that these facilities are properly protected against corrosion, and at the lowest possible cost per square foot per year.

Responsibilities for protecting a municipality's facilities from corrosion normally are scattered among a number of departments. Accordingly, the degree of success in fighting corrosion is likely to be highly variable. A good first step toward increasing the success rate is to place a single individual in charge of all corrosion-fighting activities within the jurisdiction.

The Phillips Petroleum Company reports that the cost of administering a good maintenance-painting program will be about 15 percent of the total painting cost. This percentage includes salaries, benefits, and expenses for administrators, engineers, inspectors, and supporting clerical assistance. The company also estimates that a good program can save as much as 50 percent of the total cost of painting. This means that every dollar invested in a good painting-management program will save more than three dollars — a very attractive return.

But properly managing an agency's painting program doesn' start with an inventory of the structures that may need painting. It begins with the selection of the proper coating for new structures before they are placed in service. Proper coating selection will eliminate the costly effort that must otherwise be expended in attempting to maintain a structure that was improperly coated initially.

Recoating any structure because of a coating failure is far more costly than coating it properly in the beginning. Once the structure has been put into service — filled with water or wastewater, opened to traffic, whatever — it is a far more complex and time-consuming process to repair or replace the initial coating than was the original job.

Choosing the correct coating is more demanding now than it was some years ago. Then, most paints were simple blends of natural oils and pigments. Today, such exotic coatings as zinc-rich primers, epoxies, urethanes, chlorinated rubbers, and vinyl acrylics require specific types of surface preparation, application conditions and techniques, and curing and recoating times.

In return for the more demanding con-

Without properly selected and applied protective coatings, this wastewater treatment plant in Cincinnati, Ohio, would quickly succumb to corrosive attack.

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Materials cost for field-painting structural steel

Coating type	Specified dry-film thickness, per coat	Cost per square foot (Dollars) Spray	Roller or brush
Alkyds			
Primer	2.0	0.046	0.036
Gloss topcoats	1.5	0.030	0.023
Silicone alkyd	2.0	0.074	0.058
Latex			
Primer	2.0	0.043	0.033
Topcoats	1.5	0.039	0.030
Epoxy ester			
Primer	1.5	0.036	0.028
Topcoats	1.5	0.043	0.033
Universal primers (Tie coats)			
One-pack (Phenolic modified alkyd)	2.0	0.049	0.038
Two-pack (epoxy)	2.0	0.057	0.044
	5.0	0.143	0.111
Zinc-rich primers			
Inorganic, self-cure	3.0	0.111	Spray only
Organic, epoxy	3.0	0.120	0.093
Epoxy			
Primer	2.0	0.054	0.042
H.B. intermediate/topcoat	4.0	0.091	Spray only
Finish (enamel) coat	2.0	0.057	0.044
Chlorinated rubber			
Primer	2.0	0.074	0.058
H.B. intermediate/topcoat	4.0	0.160	0.058
Finish (enamel) coat	1.0	0.060	0.047
Solution vinyls			
Primer	1.5	0.094	Spray only
H.B. intermediate/topcoat	4.0	0.177	Spray only
Finish (enamel) coat	1.5	0.064	Spray only
Urethane			
Polyester urethane	1.5	0.069	0.054
Acrylic urethane	1.5	0.057	Spray only
Coal-tar epoxy			
Standard	8.0	0.103	Spray only
C200	8.0	0.114	Spray only

Labor and equipment costs

Procedure	Cost (Dollars per square foot)		
Clean to SSPC Standard	**East**	**Gulf**	**Central and West**
SP 2 Wire brush	$0.30	$0.33	$0.35
SP 3 Power tool	0.40	0.44	0.45
SP 7 Brush-off blast	0.32	0.35	0.38
SP 6 Commercial blast	0.55	0.60	0.65
SP 10 Near-white blast	0.75	0.75	0.85
SP 5 White metal blast	1.00	1.05	1.10
Apply primer			
One package	0.13	0.12	0.14
Two-package epoxy	0.18	0.17	0.19
Zinc-rich	0.25	0.22	0.27
Touch up	0.12	0.12	0.14
Additional coats			
One package	0.13	0.12	0.14
Two-package epoxy or urethane	0.18	0.17	0.19

Source: *Coating work costs and estimating*, A. H. Roebuck, Fluor Engineers, and G. H. Brevoort, Sigma Coatings.

ditions imposed by these coatings, they provide greater resistance to severely corrosive atmospheres, high temperatures, radiation, acid fallout, abrasion, and other harsh conditions. They are engineered to last for specific life cycles if applied as intended, and with minimal maintenance demands.

Choosing the correct coating for a specific application is a complicated process. If a jurisdiction has assigned responsibility for coatings to a specific individual, this person can start and maintain the record system that will show how well particular coatings performed under the various ambient and application conditions present at that location.

In the absence of local experience, the paint specifier should consult with coating suppliers. These companies have strong financial incentives to recommend systems that perform to the owners' requirements. As basic backup, the specifier should refer to coating selection materials published in the *NACE Corrosion Engineer's Reference Book* published by the National Association of Corrosion Engineers, and in the two-volume *Steel Structures Painting Manual* published by the Steel Structures Painting Council.

One problem with the newest coating formulations is their lack of a performance history. The earliest post-cure inorganic zinc coatings, for example, have now compiled records of 20 to 23 years of successful use. By contrast, an alkyd tank enamel used in the mid- to late '60s lasted only ten years before failing. The specifiers who chose between those two coatings had no historical basis for knowing which would achieve a 20-year working life. One did; the other did not. Experiences like this show the importance of a conservative attitude in accepting new products on public projects.

A technique for increasing the probability of getting satisfactory coatings is to compile a list of approved suppliers. Suppliers on the list should have a record of satisfactory performance, and should be capable of supplying all of the jurisdiction's coatings. The jurisdiction can then take bids on an entire year's estimated supply of coatings, gaining the economy of bulk purchasing and a reputation as a major customer worthy of special service consideration. In turn, the jurisdiction not only can purchase paint for use in its maintenance painting program, but also can sell it on a cost basis to contractors coating new public structures or repainting existing ones.

Selecting the best coating for a particular application is only one aspect of attaining satisfactory coating performance. For one thing, it is rarely a single coating that is selected for a given structure, but a series of coatings: a primer, one or more intermediate coats, and a topcoat. All of these must not only be selected for the particular application, but they must be

Service life of typical coatings by type of exposure

Coating system	Surface preparation[1]	Dry film thickness (mils)	Years of corrosion protection, by exposure							
			Mild	Moderate	Severe	Caustic	Acid	Fresh or salt water	Halogens	Solvents
2-coat alkyd	2,3	3.5	2	1	½	N	N	N	N	N
3-coat alkyd	2,3	5.0	4	2	1	N	N	N	N	N
	6	5.0	7	5	3	N	N	N	N	N
3-coat alkyd shop prime, tie coat, HB Epoxy	2,3	8.0				(See note 2)				
2-coat latex	2,3	3.5	2	1	½	N	N	N	N	N
3-coat latex	2,3	5.0	4	2	1	N	N	N	N	N
	6	5.0	7	5	3	N	N	N	N	N
2-coat epoxy	2,3	6.0	4	3	2	3	2	N	N	N
	6	6.0	7	6	5	4	4	N	2	4
3-coat epoxy	6	10.0	10	8	6	6	6	N	5	6
	10	10.0	11	9	8	8	6	5[3]	6	7
2-coat epoxy universal primer/ HB epoxy	2,3	9.0	8	7	5	4	4	N	3	4
2-coat IOZ/HB epoxy	6	7.0	8	7	6	5*	4*	N	4	5
3-coat IOZ/HB epoxy	6	11.0	11	9	7	7*	5*	N	5	6
	10	11.0	12	10	7	7*	6*	6	5	7
3-coat IOZ/HB epoxy/ polyester urethane	6	8.5	11	9	6	7*	5*	N	3	7
	10	8.5	12	10	7	7*	5*	N	4	7
3-coat IOZ/HB epoxy/ acrylic urethane	6	8.5	11	9	6	6*	4*	N	3	5
3-coat IOZ/HB epoxy/ acrylic latex	6	8.5	7	6	5	N	N	N	N	N
3-coat epoxy zinc/HB epoxy	6	11.0	11	9	6	7*	5*	N	5	5
	10	11.0	12	10	8	7*	6*	6	5	5
3-coat epoxy zinc/HB epoxy/ polyester urethane	6	8.5	11	9	6	7*	5*	N	4	7
3-coat epoxy zinc/HB epoxy/ acrylic urethane	6	8.5	11	9	5	7*	5*	N	4	5
2-coat vinyl	6	5.5	5	4	3	3	3	N	1	N
	10	5.5	8	7	5	4	5	4	4	N
3-coat vinyl	6	9.5	7	6	5	4	5	N	3	N
	10	9.5	10	8	6	6	7	5	5	N
3-coat IOZ/HB vinyl	6	11.0	12	10	8	6*	7*	N	5	N
2-coat chlorinated rubber	6	6.0	5	4	3	3	3	N	1	N
	6	10.0	7	6	5	4	6	N	3	N
3-coat chlorinated rubber	10	10.0	9	7	6	6	7	5	5	N
3-coat IOZ/HB chlorinated rubber	6	11.0	10	9	7	4*	7*	N	5	N
2-coat coal-tar epoxy	6	16.0	8	7	6	6	4	N	N	N
	10	16.0	10	9	8	7	6	7	N	N
2-coat IOZ/coal-tar epoxy	6	11.0	8	7	6	6	4*	N	N	N
3-coat IOZ/coal-tar epoxy	6	19.0	9	8	7	7*	4*	N	N	N
	10	19.0	10	9	8	7*	4*	7	N	N

Notes: **(1)** Surface preparation is in accordance with Steel Structures Painting Council (SSPC) standards. SP 2 is wire brushing by hand; SP 3 is power-tool cleaning; SP 6 is commercial-grade blast cleaning; SP 10 is near-white blast cleaning.
(2) No accurate estimate is possible because of variations in surface preparation and quality of shop primer. If both are good, service life should approximate that of a two-coat epoxy system applied over a surface cleaned to SP 2 or SP 3 standards.
(3) Six years in fresh water
(*) Assuming topcoat remains intact and zinc is not exposed.
IOZ: Inorganic zinc. **HB:** High-build. **N:** Not recommended.

Source: *Coating work costs and estimating,* A.H. Roebuck, Fluor Engineers, and G.H. Brevaort, Sigma Coatings

compatible with each other.

And there are other questions that must be addressed:

- In what thickness shall each layer be applied?
- What application techniques are required?
- What application conditions are acceptable?

All of these questions are answered in the coating specification. The specification is a written blueprint describing in exact detail what is to be coated, with what materials, and how it is to be done. The specification is the instrument that the painting inspector uses to determine the acceptability of the work done by the coating contractor — or by the department's own painting crew, if the job is an in-house maintenance project. In fighting corrosion, public works crews must be held to the same standards as contractor's forces.

If the specification is not written clearly, contractors bidding on the work will not understand what is expected. The low bidder is very likely to have underestimated the work required, causing constant disputes with the department. Worse, the inspector may not be able to show that the contractor is in violation of the specifications, so the jurisdiction will not obtain the protection that it anticipated.

For example, a specification may state some specific total coating film thickness. This is inadequate; the specification should state the required dry film thickness and the tolerance limits for each individual application. Otherwise, the contractor may use a thick film of the less expensive coating and a thin film of costly material. Alternatively, he may attempt to eliminate one application by applying a layer of excessive thickness.

Specifications should avoid catch-all phrases designed to protect the jurisdiction or the specification writer. For example, if a two-coat system is to be applied, the specification should not state that "additional coats may be required to obtain complete hiding of previous coats and to provide the total minimum dry film thickness specified." If the specifications state exactly what is required, these additional "weasel words" only create apprehension in the mind of the bidder, who will raise his bid to cover contingencies.

Any discussion of specifications would be incomplete without acknowledging that they are totally ineffective without inspection to ensure that they are followed. Very few uninspected jobs comply with specifications.

An inspector who knows painting and is tough enough to demand good painting practices must be on the job. Full-time inspection is preferred. If this is impossible or impractical, as on small jobs, then the inspector should be on hand at key stages.

He should be there to check surface preparation before any coating is applied, evaluating the degree of cleanliness and the depth of profile. He should observe the mixing of the coatings. He should inspect the surface after the primer has been applied and after each subsequent coating application. He should verify the coating thickness and the application techniques, and should check for such defects as a contaminated surface, dry-spray, runs and sags, orange peel, fish-eye, overspray, surface cracking, and the like.

Inspectors need not be graduate engineers. Most are ex-painters who have demonstrated the appropriate attributes and have been trained to perform the job. Unfortunately, training is too often inadequate. In addition to on-the-job training by senior personnel, inspectors should be sent to appropriate short courses and technical symposia.

Inspecting surface preparation is not only the inspector's first responsibility, it is one of the most important. The finest coating, applied in the most conscientious manner, cannot adhere to an improperly prepared surface. On new steel construction, the standard for surface preparation is cleaning with an abrasive blast. The Steel Structures Painting Council has established standards for various degrees of cleanliness. For example, SSPC Specification *SP 10* defines near-white blast cleaning. Other SSPC specifications define other types of blast cleaning, hand-tool cleaning, and solvent cleaning.

Although photographs are available to show the degree of cleanliness required by the various grades of blast cleaning, it is preferable on larger projects to blast a sample panel at least one foot square to a condition that represents the specifications. This panel can then be coated with a non-yellowing clear coating and kept at the jobsite to use as a standard.

In addition to the degree of cleanliness, the blast cleaning specification should specify the finished surface profile, or the depth of indentations caused by the abrasive. A good rule of thumb calls for a profile that is approximately one-third the thickness of the coating. Too shallow a profile, and the coating may not adhere. Conversely, a five-mil coating would not properly protect a surface blasted to a three-mil profile.

For maintenance painting of an existing structure, abrasive blasting creates problems. The abrasive can infiltrate operating machinery and cause maintenance problems or failures. It is a nuisance to workers and the public. Spot blasting of the damaged portions of the coating will produce star-shaped fractures on the adjacent undamaged coating.

If the area to be repainted is comparatively small, adequate cleaning may be obtained with hand tools. For more than the smallest areas, power-tool cleaning is faster, less expensive, and considerably

more effective in removing heavy scale. SSPC standards cover both hand cleaning and power-tool cleaning.

For larger areas, water blasting is an effective cleaning technique that is less expensive than power-tool cleaning because it is less labor intensive. Water at a pressure of from 5000 to 10,000 PSI will remove loose coatings and loose scale. In addition, it thoroughly removes most surface contaminants, something not necessarily accomplished by abrasive blasting.

The difficulty with water blasting is that it can cause flash-rusting of the steel. This can be counteracted by incorporating a corrosion inhibiter in the water. Inhibitive solutions will prevent flash rusting for as long as 24 hours in humid conditions. Of course, the corrosion inhibitor must be selected to be compatible with the primer and the exposure. Some inhibitors that actually improve the performance of a particular coating system in atmospheric service may cause failure where the coated surface is immersed. Then, too, the amount of inhibitor deposited on the surface must be carefully controlled so that the film will not prevent the coating from adhering to the metal.

Surface preparation is only one area in which maintenance painting differs from the coating of new structures. Because most public works officials are responsible for a substantial amount of maintenance painting but may have few opportunities to control the painting of a new structure, they often find that the majority of painting literature does not apply to their situations.

There are two basic management approaches to maintenance painting. One is to wait as long as possible between repaintings, essentially until the entire coating has failed, and then recoat the structure. The second is to schedule maintenance as soon as localized corrosion has affected about 5 percent of the structure. At this time, the entire coating can be presumed to be at the point where rapid deterioration is imminent.

Cost analyses reported by the Carboline Company indicate that it is less costly to maintain the existing system than to completely repaint. Repair of the localized damages and a topcoat of the entire structure arrests corrosion and renews the protection offered by the existing system.

Completely recoating a structure after its ten-year coating has failed is far more expensive on an annual cost-per-square-foot basis than local repair and a new topcoat at five years. Moreover, the structure will be better protected against corrosion by the repair and recoating at five years. In fact, according to Carboline, the objective of an effective maintenance painting program can be defined as stopping coating deterioration and corrosion at its early stages so that the protection provided by an intact coating system can be preserved.

If this premise is accepted, it places another restriction on coating selection. Recoating an existing coating requires that the two materials be compatible. For example, thermosetting coatings, such as epoxies, develop a high degree of solvent resistance as they age. Top coats normally will not significantly soften these coatings, so adhesion is impared. Conversely, thermoplastic coatings, such as vinyls, maintain low solvent resistance. The solvents in a top coat could dissolve the existing coating to the extent that it could lift from the substrate.

Maintenance painting coatings must be compatible with the many types of existing coatings found in the jurisdiction. In addition, the coating specifier should select coatings for new structures that are compatible with the maintenance systems in use by the jurisdiction. Primers are especially important. These should be selected so that a variety of top coatings can be applied for the specific conditions of the exposure.

Maintenance painting often must be conducted under adverse conditions. Few sophisticated coatings should be applied at temperatures of less than 50F. Even if the coating is kept in a heated building until it is at an appropriate temperature, it will almost immediately assume the temperature of the surface onto which it is applied. When applied to cold steel, it will become very viscous and will not easily flow into the irregularities created in the surface by cleaning. This will result in a diminished mechanical bond.

If the coating is applied on a hot surface, conversely, it may sag at low film thicknesses. Adhesive strength may also be affected adversely.

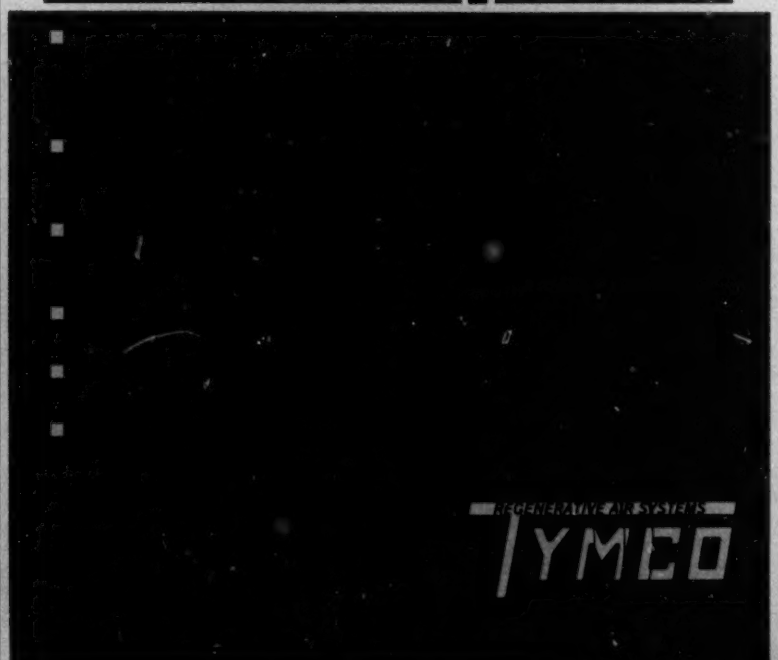
Condensation and wind during coating application also affect performance. While most high-performance coatings are highly resistant to water damage after they have dried, a very small amount of water on the surface or in the coating before it has cured can significantly affect its properties and longevity.

If paint is applied at a temperature of 80F and 90 percent relative humidity, condensation can occur with only a three degree drop in temperature. This drop can be caused just by the evaporation of the solvent in the coating. Droplets of moisture will condense on the surfaces of the particles and become entrapped in the film. This will prevent proper film formation and reduce corrosion resistance of the coating.

On a windy day, coating droplets applied by spray may arrive at the surface in a partially dried state. They will not coalesce into the main body of the film, reducing its effectiveness.

The potential effects of such conditions as relative humidity and wind speed suggest that the painting manager's records would not be complete if they included only the dates of painting and the types

Unique Features of Tymco's Regenerative Air Sweepers:



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and manufacturers of coatings applied. The application conditions are an equally important part of the record. If a coating fails after a few years, it will be almost impossible to reconstruct accurately the conditions under which it was applied. Only complete records will provide the information.

The painting manager inevitably will come under pressure to reduce costs. The only rational way to cut costs is to ensure that coatings that will provide the longest life are selected, and that they are applied correctly.

The way not to reduce costs is by cutting corners. The reduction in service life will cost the jurisdiction far more than the relatively minor savings in coating expense.

There are three areas where ill-advised cost-cutting methods predominate:

Surface preparation. If the surface requires sandblasting, this might be accomplished at a cost of $3.00 per square foot. If hand cleaning is substituted, the maximum savings will be $0.30 per square foot. However, failures can be expected in one to three years, rather than the ten years that might be expected if the surface were properly blasted. Moreover, repaintings, since they will be done on a poorly prepared surface, will continue to be required at more frequent intervals.

Coating quality. Coating materials cost between 10 and 25 percent of the total cost of a painting contract. Even if the cost were at the high end of this range, and if a coating could be found that cost only half as much as the proper coating — a very dubious assumption, as poor quality or improperly selected coatings often cost as much as the correct coating — then the maximum saving on the job would be 12½ percent. The poor coating probably will require repainting in about five years, rather than the 10 to 20 years that should be attained.

Film thickness. The same conditions apply to film thickness as to coating quality. If the proper coating is applied at only half the required thickness, the maximum total saving on the job will be 12½ percent. Again failure can be expected in from three to five years.

The worst possible condition is when all three of these shortcuts are used on the same job. The result is swift, dramatic failure, and the need for a total recoating job.

If painting management is to achieve its objective, corrosion protection at the lowest possible cost per square foot per year, than every aspect must be controlled. The proper coatings must be selected, careful specifications must be written for their application, and the job must be inspected to ensure that the intent of the specifications is achieved. Failure in any of these areas means either higher painting costs, reduced corrosion protection, or both. **ACC**

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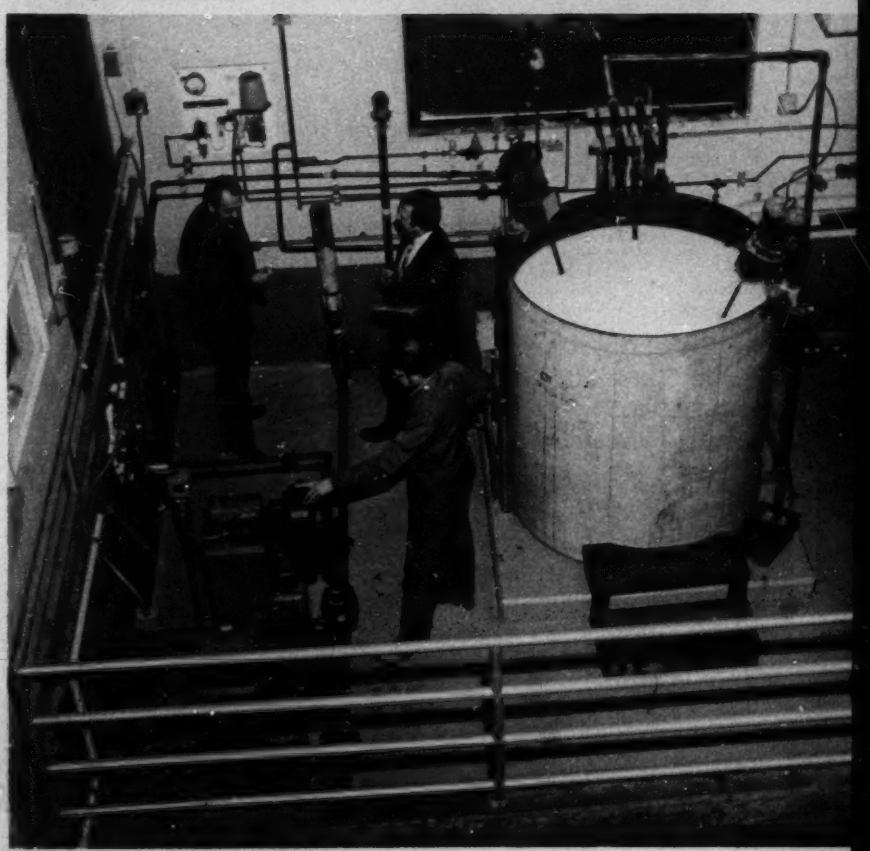
Polymers boost sludge filter press de

Replacing ferric chloride and lime with an organic polymer at the Aberdeen, Washington, sewage treatment plant reduced sludge dewatering costs by 44 percent.

James Barkman
Waste Water Systems Manager
Aberdeen, Washington



Secondary sludge dewatering with a plate-and-frame filter press usually includes addition of ferric chloride and lime to improve filtration characteristics. Organic flocculants have been tried in this application, but generally have been rejected because of the fragility of the floc.

But with some development work at the Aberdeen, Washington waste treatment plant, the city was able to modify the plant slightly and successfully apply the organic polymer. The change reduced operating costs by 44 percent.

The City of Aberdeen started up a new sewage treatment plant in January, 1981 to process 4.7 million gallons of domestic, commercial, industrial, and infiltration waste water per day. The water contains a daily average of 6510 pounds BOD, 7150 pounds suspended solids, and 500 pounds of grease.

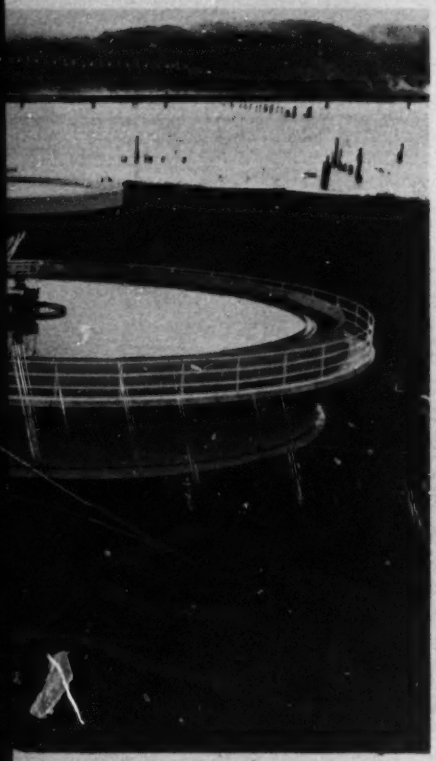
Treatment consists of mechanical degritting, primary clarification, secondary aeration basins, secondary clarification, gravity sludge thickening, sludge dewatering, and sludge incineration. Effluent water is discharged into the Chehalis River.

Sludge dewatering and incineration operations normally cost the city more than $100,000 a year. Replacement of the inorganic coagulants with a polymer offered opportunities for savings in chemicals, electricity, labor, sludge disposal and equipment. The ferric chloride-lime system had been specified for this plant because organic flocculants historically have not performed well with a filter press.

It was felt that past failures with organic cationic flocculants were caused by forcing the polymer into systems designed for different types of chemicals. Tests in the laboratory and plant indicated the following conditions were important for successful polymer application:

Point of application — Polymer treated sludge is fragile. And pumping usually shears the floc and makes the sludge harder to filter. Ideally, the organic flocculant would be mixed with the

waterability



The Aberdeen, Washington sewage treatment plant saved 44 percent of dewatering costs by switching from ferric chloride and lime to organic polymer flocculants. Pictured above are the plant's secondary clarifiers. Each batch of sludge must be individually tested to determine the optimum amount of polymer to be added (below).

sludge after the transfer pumps and before the filter. This was not possible in the Aberdeen plant set-up because the polymer metering pumps were unable to overcome the head of the press feed pumps.

Jar tests indicated that there is a 10 to 15 second delay between mixing the polymer with the sludge and floc formation, so the polymer was injected to the suction side of the press feed pumps, avoiding the high injection pressures. The pumps provide excellent mixing, yet the mixture passes through the pumps before the floc forms and so it does not lose any of its dewatering characteristics.

Polymer solution concentration — Metering pump capability required that the chosen polymer, NALCO 7120, be added as a 20 percent solution. It was determined that the 20 percent polymer solution could be used without loss of activity by adding dilution water immediately downstream from the metering pumps. This preserved the polymer activity and did not require the addition of extra metering pump capacity.

Washing the filter cloth — The ferric chloride-lime system required routine washing of the filter cloth to keep it clean and prevent the sludge cake from sticking in the press. Tests with the polymer indicated that it is best to run with the filter cloth unwashed, since the small amount of sludge remaining on the cloth acts as a release agent. It was found that the weekly pressure washing schedule with the ferric chloride-lime system could be reduced to once every 14 days for the polymer. This resulted in less sticking and significant manpower savings.

Polymer dosage — Jar tests indicated that polymer dosage was not critical as long as certain minimum requirements were met to form a good floc. However, plant experiments contradicted this, showing that excess polymer caused the filter cake to stick in the press. The polymer dosage must be adjusted to the lowest application rate that gives a good floc without fouling the filter cloth. The tendency to over-treat the sludge with polymer must be avoided.

Since filter press operation is a batch process, a simple test was devised to determine the correct ratio of sludge to polymer for each batch. A 100 ml sample of sludge was mixed with varying amounts of NALCO 7120 polymer until a floc began to form. The ratio of sludge volume to polymer volume was used to set the metering pumps for each filtration run.

While the ferric chloride-lime system required an average of 100 pounds ferric chloride and 300 pounds of lime per dry ton of sludge, the organic flocculant required only 75 to 100 pounds of chemical per ton of sludge. The net result of dosage and price differences reduced projected chemical treatment cost by $27 per dry ton of sludge or $20,000 for 730 tons of sludge.

Use of the organic flocculant also increased throughput of the filter press. While every dry ton of ferric chloride-lime sludge contained 400 pounds of added inorganic ash, the polymer-treated sludge contained almost no added contaminants. Production increased because the filter press was no longer processing the "dead" inorganic load. Also, less press wash time and general plant clean-up were needed when using the organic flocculant. This allowed cutting from a two-shift to a one-shift operation — a saving of 40 man-hours per week, equivalent to $23,000 per year.

Also as a result of this work, the entire lime storage, processing, and handling system was no longer needed. Reduction of equipment repair and replacement resulted in a projected annual savings of $3,000.

The low ash content of organically treated sludge improved sludge incineration and reduced both labor and electrical requirements. This resulted in a projected annual savings of an additional $3,000.

And ash from the incinerated sludge decreased by 400 pounds per ton of dry sludge to give an annual savings for transportation and disposal of $3,000.

Utilization of organic cationic flocculant in the Aberdeen Sewage Plant reduced operating costs by $52,000 per year. This is a 44% reduction in sludge handling expense or 3.8 percent of the overall waste treatment operating budget. **ACC**

Annual Savings Attributed to Polymer Use

Cost Item	$FeCl_3$ + Lime System	Polymer System	Annual Savings
Chemicals	$ 31,170	$10,950	$20,221
Electricity	10,130	6,788	3,342
Ash Disposal	8,200	5,112	3,088
Labor	65,820	43,422	22,398
Maintenance & Replacement of Lime System	2,720	0	2,720
	$118,040	$66,272	$51,769
Cost per Ton Dry Sludge	$162	$91	$71

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Municipal Cost Indexes

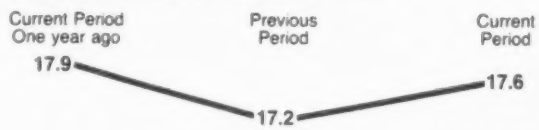
Cost Index Figures of the Month, showing 30-day, 12-month changes (1967 = 100)

ACC MUNICIPAL COST INDEX 315.4 +0.2% +3.6%

Consumer Price Index	293.1	0.2%	3.6%
ACC Construction Cost Index	355.2	0.2	5.8
ACC Construction Materials	311.1	1.0	2.0
ACC Motorized Equipment	301.6	0.2	4.7
ACC Energy: Fuels and Power	896.5	(1.2)	1.5
ACC Consumable Supplies	300.4	0.3	1.4
Producer Price Index	283.6	(0.5)	2.1

MUNICIPAL TREND TO WATCH

Purchases of Structures, Billions of Dollars



Current Reference Period: **Third Quarter 1982**

Seasonally adjusted annual rate

CAPITAL EQUIPMENT 285.7 +0.2% +3.4%

Agricultural Machinery & Equip.	321.4	0.5%	6.0%
Air Conditioners (12/77 = 100)	141.3	0.4	4.1
Construction Machinery & Equip.	348.6	0.2	3.4
Electric Motors	298.8	0	2.6
Environmental Controls (6/80 = 100)	123.6	2.4	10.8
Fans and Blowers	336.5	0	0.6
Generators and Generator Sets	340.2	2.7	4.5
Heating Equipment	240.1	0.3	2.9
Industrial Material Handling Equip	286.6	(0.1)	0
Integrating & Measuring Inst.	218.9	1.2	6.5
Internal Combustion Engines	335.3	0.1%	5.7%
Lawnmowers	250.4	0.8	9.0
Motor Trucks, Light	275.3	0	1.3
Motor Trucks, Heavy	317.5	0	6.8
Office Machines	154.4	0.6	3.5
Passenger Cars	218.8	0	1.6
Photographic Equipment	128.6	0	(2.1)
Pumps, Compressors & Equipment	349.6	0.4	2.3
Refrig. Compressors (12/77 = 100)	—	—	—
Switchgear, Switchboard Equip.	262.1	0.2	0.5

INDUSTRIAL COMMODITIES 315.3 (0.1)% (0.3)%

Abrasive Products	299.9	0.5%	4.2%
Apparel	192.9	0.6	0.1
Asphalt Roofing	392.2	(0.8)	(2.3)
Building Paper and Board	240.5	(0.4)	2.9
Coal	532.3	(1.5)	1.3
Commercial Furniture	281.6	0.9	5.6
Concrete Products	298.6	0	1.0
Diesel Fuel (2/72 = 100)	789.9	(4.0)	(5.8)
Electric Lamps/Bulbs	299.2	0.7	8.7
Electric Power	411.2	0.2	4.7
Electronic Components	178.8	0.2	2.5
Fabricated Structural Metal	303.3	(0.4)	0
Finished Lubricants	352.9	(0.1)	1.5
Finished Steel Products	343.7	(0.5)	(2.0)
Flat Glass	229.7	2.0	6.2
Floor Coverings	181.0	0.5	0.4
Footwear	247.5	(0.3)	3.6
Footwear, Rubber	225.8	(0.1)	2.0
Foundry Products	346.1	0	0.9
Fuel Oil, No. 2 (2/73 = 100)	795.0	(8.3)	(9.1)
Gasoline	630.4	(3.6)	(11.6)
Glass Containers	358.2	(0.1)	6.8
Gypsum Products	259.7	2.3	3.7
Hardware	284.9	0.5	3.9
Hydraulic Power Eq. (12/70 = 100)	248.9	0	4.9
Industrial Chemicals	339.9	(0.9)	(6.3)
LP Gas	718.1	(3.4)	8.6
Lumber, Hardwood	267.2	0.4	3.1
Lumber, Softwood	337.8	5.4%	5.0%
Millwork	293.7	2.7	6.0
Mixed Fertilizers	261.5	(0.8)	(2.4)
Motor Vehicle Parts	352.6	0	4.0
Natural Gas	1417.7	(2.7)	18.0
Nonferrous Wire and Cable	201.8	1.9	(2.0)
Paint Materials	301.3	(0.1)	(1.7)
Paper	279.8	(0.1)	(3.3)
Pesticides	457.4	(2.3)	(0.4)
Photographic Supplies	271.5	0	1.3
Plastic Constr. Prod. (12/69 = 100)	152.3	(0.5)	0.6
Plastic Film (12/70 = 100)	214.3	0	3.4
Plumbing Fixtures & Brass Fittings	280.6	0.5	2.2
Plywood	234.4	1.4	(1.3)
Portland Cement	324.2	(1.4)	(4.5)
Prepared Paint	265.1	0	2.4
Refractories	338.2	0.1	6.8
Residual Fuel	1126.7	0.5	(7.6)
Sand, Gravel & Crushed Stone	284.9	0.4	5.1
Sanitary Papers & Health Prod.	363.2	0.2	4.1
Soaps & Synthetic Detergents	257.6	0.8	2.3
Sporting Goods	207.0	(0.6)	2.5
Structural Clay Products	264.4	0	2.7
Tires and Tubes	259.1	1.1	2.2
Tractor Parts	—	—	—
Transformers & Power Regulators	220.3	0	0.4
Valves & Fittings* (Dec 82–100)	100.3	0.3	—
Wiring Devices	328.2	0.1	2.9

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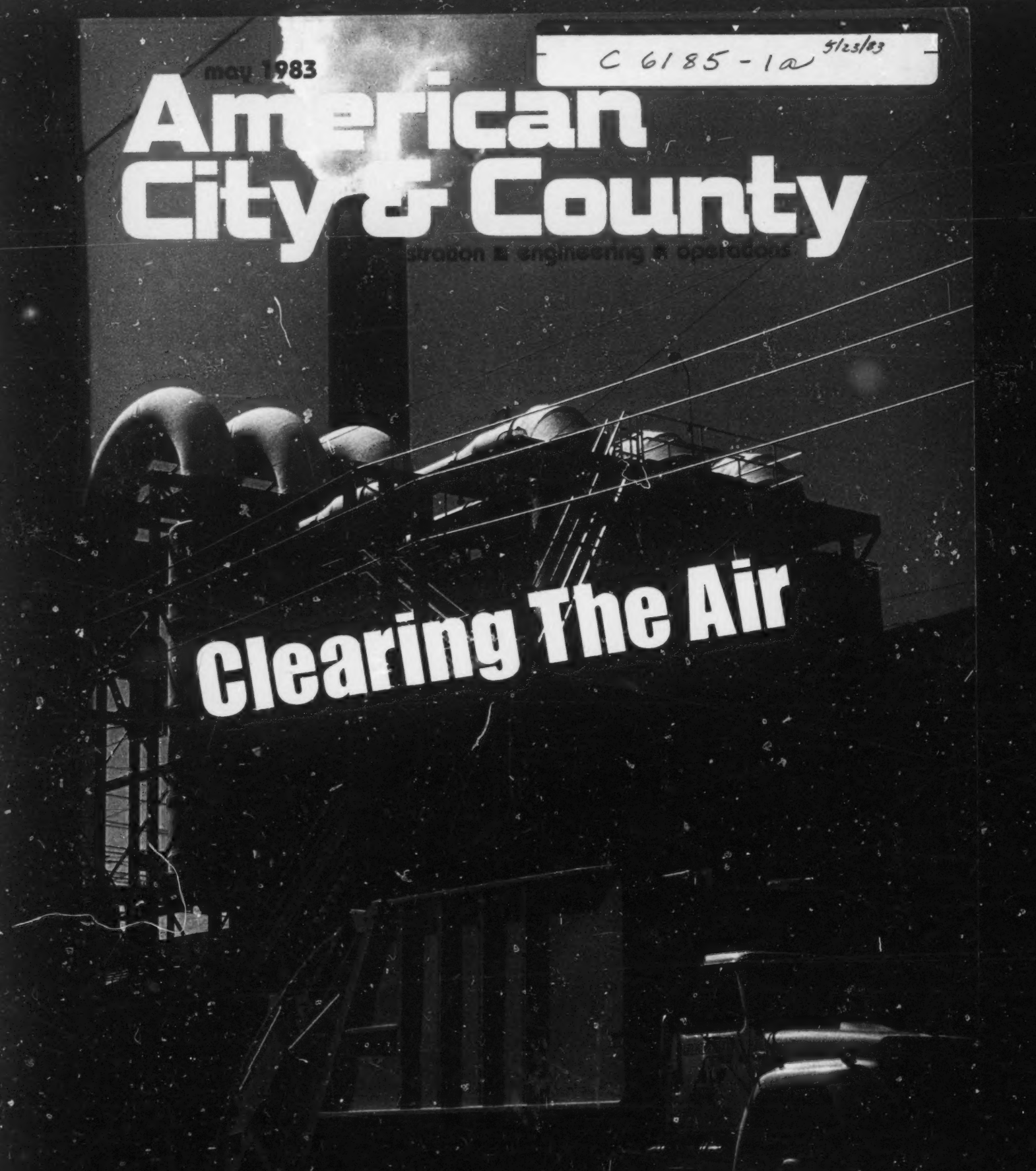
may 1983

American City & County

stratton ■ engineering & operations



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Tel: 413 499-2550
Gary M. Chamberlain, senior editor
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John Foster, senior editor
Martha Eischen, computer talk
Kathleen Richards, editorial assistant
Susan O'Connor, production manager
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Municipal Cost Indexes

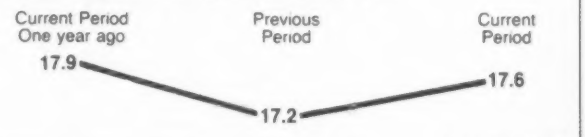
Cost Index Figures of the Month, showing 30-day, 12-month changes (1967=100)

ACC MUNICIPAL COST INDEX 317.0 +0.5% +3.9%

Consumer Price Index	293.2	0%	3.5%
ACC Construction Cost Index	359.8	1.3	6.9
ACC Construction Materials	317.6	2.1	3.7
ACC Motorized Equipment	301.8	0.1	5.0
ACC Energy, Fuels, Power	895.7	(0.1)	2.3
ACC Consumable Supplies	298.8	(0.5)	0.2
Producer Price Index	283.7	0	2.1

MUNICIPAL TREND TO WATCH

Purchases of Structures, Billions of Dollars



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Seasonally adjusted annual rate

CAPITAL EQUIPMENT 286.2 +0.2% +4.1%

Agricultural Machinery	322.5	0.3%	5.9%	Internal Combustion Engines	335.5	0.1%	4.9%
Air Conditioners (12/77 = 100)	142.0	0.5	4.6	Lawnmowers	250.5	0	9.0
Construction Equipment	348.1	(0.1)	3.0	Motor Trucks, Light	275.5	0.1	8.9
Electric Motors	302.3	1.2	3.5	Motor Trucks, Heavy	317.5	0	6.8
Environ. Controls (6/80 = 100)	125.2	1.3	9.2	Office Machines	154.1	(0.2)	2.5
Fans and Blowers	336.5	0	0.8	Passenger Cars	218.9	0	4.0
Generators, Generator Sets	340.4	0.1	4.6	Photographic Equipment	130.7	1.6	(0.5)
Heating Equipment	240.8	0.3	3.3	Pumps, Compressors	349.4	(0.1)	1.2
Industrial Material Handling	285.3	(0.5)	(0.7)	Switchgear, Switchboards	263.8	0.6	1.0
Integrating and Measuring	220.5	0.7	6.3				

INDUSTRIAL COMMODITIES 315.9 +0.2% -0.2%

Abrasive Products	305.2	1.8%	3.4%	Lumber, Softwood	362.8	7.4%	13.8%
Apparel	193.3	0.2	0.1	Millwork	300.5	2.3	7.9
Asphalt Roofing	378.9	(3.4)	(5.4)	Mixed Fertilizers	260.1	(0.5)	(4.2)
Building Paper and Board	240.8	0.1	4.1	Motor Vehicle Parts	352.8	0.1	3.1
Coal	534.6	0.4	0.9	Natural Gas	1463.2	3.2	19.9
Commercial Furniture	282.6	0.4	4.2	Nonferrous Wire, Cable	205.9	2.0	0.1
Concrete Products	299.5	0.3	1.2	Paint Materials	299.3	(0.7)	(2.3)
Diesel Fuel (2/72 = 100)	744.3	(5.8)	(11.1)	Paper	279.1	(0.3)	(3.7)
Electric Lamps, Bulbs	304.8	1.9	9.0	Pesticides	459.6	0.5	0.1
Electric Power	411.2	0	4.7	Photographic Supplies	272.9	0.5	1.4
Electronic Components	180.2	0.8	2.9	Pl. Constr. Prod. (12/69 = 100)	152.0	(0.2)	(0.2)
Fabricated Structural Metal	302.5	(0.3)	(0.5)	Plastic Film (12/70 = 100)	212.3	(0.9)	2.2
Finished Lubricants	354.0	0.3	1.5	Plumbing Fixtures	283.4	1.0	2.5
Finished Steel Products	351.8	2.4	0.4	Plywood	239.3	2.1	1.8
Flat Glass	229.7	0	6.2	Portland Cement	327.6	1.0	(4.0)
Floor Coverings	181.2	0.1	0.3	Prepared Paint	265.1	0	2.4
Footwear	246.9	(0.2)	3.5	Refractories	338.2	0	0.9
Footwear, Rubber	225.7	0	0.7	Residual Fuel	1104.5	(2.0)	(6.2)
Foundry Products	346.8	0.2	0.7	Sand, Gravel, Crushed Stone	284.8	0	4.1
Fuel Oil No. 2 (2/73 = 100)	747.6	(6.0)	(13.3)	Sanitary Papers	366.0	0.8	4.9
Gasoline	603.8	(4.2)	(13.9)	Soaps, Detergents	257.6	0	2.3
Glass Containers	355.8	(0.7)	1.0	Sporting Goods	207.4	0.2	2.4
Gypsum Products	263.4	1.4	3.3	Structural Clay Products	264.4	0	2.6
Hardware	285.6	0.2	3.9	Tires and Tubes	250.4	—	(2.5)
Hydraulic Power (12/70 = 100)	251.4	1.0	4.4	Tractor Parts (12/82 = 100)	100.0	0	—
Industrial Chemicals	341.0	0.3	(5.9)	Transformers	223.5	1.5	0.9
LP Gas	711.2	(1.0)	13.3	Valves (12/82 = 100)	100.8	0.5	—
Lumber, Hardwood	269.3	0.8	3.5	Wiring Devices	329.6	0.4	3.0

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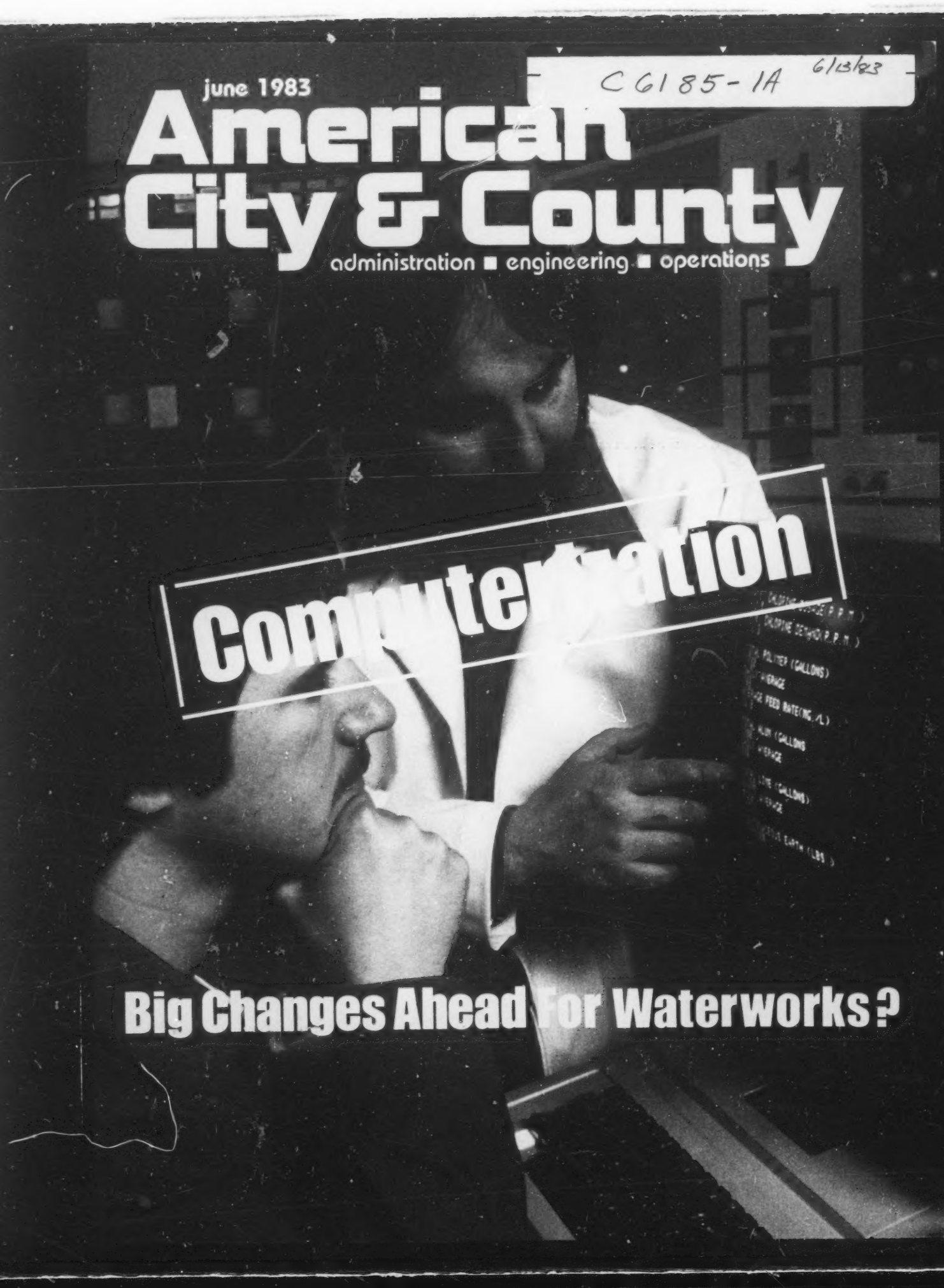

Computerization

Big Changes Ahead For Waterworks?

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William L. Forestell, editor-in-chief
Tel: 413 499-2550
Gary M. Chamberlain, senior editor
John P. O'Connor, engineering editor
John Foster, senior editor
Martha Eischen, computer talk
Kathleen Richards, editorial assistant
Susan O'Connor, production manager
Gertrude E. Bauer, circulation manager
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On the cover: Chief Operator Steve White (right) and Chief Chemist Oleh Dzydora of the 80-mgd Jersey City Water Treatment Facilities in Lake Hiawatha, N.J., check the display on one of the plant's *Apple II* computers. Photo courtesy Malcolm Pirnie, Inc.

present state of knowledge) I don't believe that role should be a regulatory one at the present time," he said.

Chafee urged his audience to "start planning for the next decade" — the post-technology decade he called it — and indicated that the Congress would soon start to lay the groundwork. "We are going to deal with compliance dates in a way that will make achievement (of the water quality goals of the Act) possible," the Rhode Island Republican said. "The only thing left will be determining what the condition of our water will be after that occurs." For those streams that do not achieve the goals because of continued pollution by toxics, further steps will have to be taken, he indicated. "That is what we must start planning for," he said.

Local officials will have to do a large part of the planning—and the paying—for pollution cleanup, according to a USEPA speaker at the same conference. Frederic A. Eidsness, Jr., the agency's Assistant Administrator for Water, laid out the framework of the EPA's latest version of a "municipal policy" on compliance, the gist of which was that municipalities would have to do "everything in their power within the limits of their resources" to comply with their effluent discharge permits.

Citing figures which showed that 96 percent of the 48,300 industrial dischargers have treatment in place or on schedule and 85 percent of those are in compliance with their effluent limitations, Eidsness contrasted the POTW picture: 69 percent of 15,600 permitted plants with treatment in place or on schedule and only 77 percent of those in compliance.

In an effort to improve performance on the municipal side, the USEPA will shortly institute a policy which will say clearly to the local official, "The responsibility is yours."

To meet the July 1988 statutory limitations, Eidsness noted, it will no longer be enough to say, "We can't afford it." The full range of local and state financial resources, along with alternative methods of financing, will have to be considered, the assistant administrator pointed out. "I believe that the burden should rest on local government to convince the regulatory agency that they are doing everything within their power to come into compliance," he said. "Nobody has the right to pollute," said Eidsness, "period, the end." ■

FLEET MANAGEMENT

Diesel power now costs more than gas

Since 1980, the average ownership and operating costs for diesel powered automobiles has climbed by slightly more than 40 percent. At the same time gasoline powered automobile operating costs climbed by only 27.6 percent.

According to the Runzheimer Reports on Transportation, a car-fleet newsletter, total annual costs are now higher for diesel-powered automobiles than for gasoline models.

From 1980 to 1981, the total costs for the diesel test car (a diesel-powered Oldsmobile *Delta 88*) climbed $585, or 14.8 percent. Costs for a similar gasoline-powered model climbed $762, or 17.7 percent. By 1982 the diesel's cost rose another $691, or 15.2 percent. The gas-engined car's cost rose $238, or only 4.7 percent. And between 1982 and 1983, total costs for the diesel increased $317 or 6.1 percent, while total costs for the gasoline version increased $188, or 3.5 percent.

According to Runzheimer editors, "Although the most recent percentage

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increase in costs does not represent a vast gap, future analysts may well look back on 1983 as the turning point for diesels, as the total costs for some diesel models began to exceed the total costs for comparable gasoline versions."

While the rising cost of diesel fuel and the falling cost of gasoline are expected to have a significant impact on fleet and truck marketing, one truck producer estimates that the recent shift toward diesel in buses and medium-duty trucks will continue. By 1985, it is estimated that 80 percent of all medium-duty trucks will be diesel powered.

Runzheimer and Co., is a Rochester, Wisconsin-based management consulting firm. ■

Gasoline versus Diesel — 1980 to 1983

	Fixed costs		Variable costs		Total costs	
Year	Gasoline	Diesel	Gasoline	Diesel	Gasoline	Diesel
1980	$2,580	$2,461	$1,720	$1,500	$4,300	$3,961
1981	3,182	2,936	1,880	1,610	5,062	4,546
1982	3,420	3,597	1,880	1,640	5,300	5,237
1983	3,658	3,954	1,830	1,600	**5,488**	**5,554**

REFUSE-TO-ENERGY

Financing set for Mass. waste plant

Financing has been completed for a $197 million refuse-to-energy project that will provide solid waste disposal for 21 northeastern Massachusetts towns.

The project, commonly known as NESWC, for the North East Solid Waste Committee of communities, represents a unique combination of public sector planning and private sector money.

Twenty-one towns and cities north and northwest of Boston have signed 20-year contracts with Massachusetts Refusetech, Inc., a subsidiary of Des Plaines, Illinois-based UOP. The company will build the facility, which Massachusetts Refusetech will own and operate, in North Andover.

The project will be financed by $160 million of tax-exempt industrial revenue bonds, and $37 million of taxable industrial revenue bonds issued by the North Andover Industrial Development Financing Authority.

Facility construction, start-up and testing of the 465,000 ton-per-year facility will require approximately three years.

According to Jack Hunter, director of business development for UOP, "This project represents a milestone in the development of an economic solution for solid waste disposal from small and medium-sized communities . . . It offers a long-term, economic alternative to landfill disposal, and more importantly, enables communities to control future solid waste disposal costs through regional cooperation."

The facility will sell the generated electrical power to the local utility, New England Power Company. The 21 communities will receive credit against services for fees from energy revenues generated by the facility. ■

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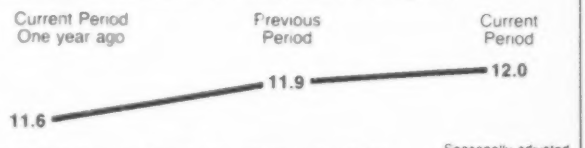
Purchases of Nondurable Goods, Billions of Dollars



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Passenger Cars	218.9	0	4.1
Photographic Equipment	131.0	0.2	(2.5)
Pumps, Compressors	347.8	(0.5)	0.3
Refrig. Compressors	142.2	0.1	4.3
Switchgear, Switchboards	264.1	0.1	0.5

INDUSTRIAL COMMODITIES 314.5 -0.4% -0.5%

Abrasive Products	305.3	0%	3.0%
Apparel	194.6	0.7	0.6
Asphalt Roofing	373.2	(1.5)	(5.4)
Building Paper and Board	243.3	1.0	1.5
Coal	540.0	1.0	2.0
Commercial Furniture	285.4	1.0	4.3
Concrete Products	300.1	0.2	1.3
Diesel Fuel (2/72 = 100)	699.3	(6.0)	(15.0)
Electric Lamps, Bulbs	305.0	0.1	10.1
Electric Power	411.7	0.1	2.0
Electronic Components	180.3	0.1	2.7
Fabricated Structural Metal	303.7	0.4	(0.3)
Finished Lubricants	353.6	(0.1)	1.1
Finished Steel Products	350.1	(0.5)	(0.1)
Flat Glass	229.7	0	6.2
Floor Coverings	181.0	(0.1)	0.2
Footwear	248.0	0.4	3.4
Footwear, Rubber	224.4	(0.6)	(0.5)
Foundry Products	350.9	1.2	1.3
Fuel Oil No. 2 (2/73 = 100)	704.2	(5.8)	(15.5)
Gasoline	584.2	(3.2)	(13.9)
Glass Containers	354.1	(0.5)	(0.5)
Gypsum Products	263.4	0	1.0
Hardware	285.9	0.1	2.8
Hydraulic Power (12/70 = 100)	251.5	0	4.3
Industrial Chemicals	339.4	(0.5)	(6.1)
LP Gas	707.7	(0.5)	21.2
Lumber, Hardwood	269.6	0.1	3.5
Lumber, Softwood	368.7	1.6%	15.6%
Millwork	304.0	1.2	9.9
Mixed Fertilizers	259.4	(0.3)	(4.5)
Motor Vehicle Parts	351.9	(0.3)	2.9
Natural Gas	1499.8	2.5	19.9
Nonferrous Wire, Cable	206.1	0.1	0.1
Paint Materials	298.1	(0.4)	(2.8)
Paper	278.6	(0.2)	(3.8)
Pesticides	463.1	0.8	0.9
Photographic Supplies	281.9	3.3	4.8
Pl. Constr. Prod. (12/69 = 100)	147.1	(3.2)	(1.3)
Plastic Film (12/70 = 100)	212.3	0	(1.2)
Plumbing Fixtures	285.5	0.7	2.3
Plywood	238.8	(0.2)	1.0
Portland Cement	326.9	(0.2)	(4.2)
Prepared Paint	265.1	0	2.4
Refractories	338.2	0	0.2
Residual Fuel	1053.0	(4.7)	(9.5)
Sand, Gravel, Crushed Stone	284.3	(0.2)	3.0
Sanitary Papers	366.2	0.1	4.9
Soaps, Detergents	258.0	0.2	2.5
Sporting Goods	206.3	(0.5)	1.7
Structural Clay Products	270.9	2.5	5.1
Tires and Tubes	250.1	(0.1)	(1.4)
Tractor Parts (12/82 = 100)	100.0	0	—
Transformers	224.2	0.3	1.1
Valves (12/82 = 100)	100.0	(0.8)	—
Wiring Devices	330.8	0.4	2.9

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American City & County

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SUSAN GARNER
SRI ACQUIS/CONGRSNL INFO SV
4520 EAST-WEST HGWY STE 800
BATHESDA MD 20814

Custodial Maintenance

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American City & County

Berkshire Common, Pittsfield, MA 01201.

William L. Forestell, editor-in-chief
Tel: 413/499-2550
Gary M. Chamberlain, senior editor
John F. O'Connor, engineering editor
John Foster, senior editor
Martha Eischen, computer talk
Kathleen Richards, editorial assistant
Susan O'Connor, production manager
Gertrude E. Bauer, circulation manager
June MacLeod, inquiries manager
Marianne Faybik, market research director

Russell Gilchrist, publisher

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CHICAGO: Bob Coyle, Two North Riverside Plaza, Chicago, IL 60606. **312-346-4611**

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NEW ENGLAND: David Campbell, Berkshire Common, Pittsfield, MA 01201. **413-499-2550**

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SAN FRANCISCO: Chuck Harrison and **Donald Taylor,** J.J.H. & S., Inc., 57 Post St., Suite 715, San Francisco, CA 94104. **415-392-6794**

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A modest 4.1 percent 12-month increase for the MCI.

On the cover: Macomb County, Michigan's shiny floors attest to the pride its custodial maintenance department takes in its work. Photos for the cover and the article were taken by the manager of that county's Building Maintenance Department, Robert Olafson.

How well do our neighborhoods really measure up?

Here's a look at the attitudes and opinions people have about the quality of life where they live based on an in-depth study by the Merit Report.* It could be a report card on city officials and their actions.

Probably no single factor affects the quality of life more than the living environment. In an effort to determine how Americans feel about this all-important issue, The Merit Report conducted a special in-depth survey about how people perceive their own neighborhoods, city vs. suburban vs. small town/rural living, and whether or not they would move if they could.

In general, the report finds a substantial, but not overwhelming, satisfaction exists among most Americans with their own neighborhoods. Also, the report reveals the public's perceptions of the major strengths and weaknesses of their neighborhoods.

And, when characterizing city, suburban or small town/rural life in general, there is great consensus. For instance, rural folk as well as city dwellers find the pace of big city life too fast, and they both agree that there's not enough to do in rural areas.

Additionally, the report reveals that half of Americans would move if they could. However, while most would change the region of the country they live in, they would opt for a similar type of neighborhood.

Specifically, the findings of the survey are as follows:

First, the report asked Americans to grade their own neighborhoods in terms of such characteristics as cleanliness, safety, privacy, and educational and social opportunities. The ratings follow a traditional grading system: "A" (Excellent), "B" (Good), "C" (Fair), "D" (Poor), and "F" (Failing). (See Table I.)

According to the overall rating, Americans express substantial, though not overwhelming, satisfaction with their own neighborhoods no matter where they live. The most significant differences, however, occur in the "A" portions of those ratings.

Breaking out the total "Excellent" responses within each category, the ratings indicate that people are most satisfied with their neighborhoods as places to raise children (48 percent). They are least satisfied with them in terms of traffic (28 percent), desirability as a place for young, single people to live (27 percent) and police protection (26 percent).

The most striking of these findings are the "Excellent" ratings for one's neighborhood as a "safe place to walk at night." According to Dr. Donald J. Treiman, UCLA professor of sociology and a consultant to the report: "Although the 21 to 50 percent margin between cities and rural areas confirms the stereotype of cities as unsafe, the finding that less than half the country (39 percent) views its neighborhood as truly safe at night — regardless of its location — indicates that there is an enormous amount of apprehension in this country."

On the other hand, the report appears to have revealed data that refutes a commonly-held assumption — that of the elderly as an opressed population. (See Table II.) In response to these same questions, older people generally express greater satisfaction with their neighborhoods than do younger people. In particular, they are more satisfied with their neighborhoods for their friendliness, cleanliness, overall upkeep of homes and apartments, and, perhaps more significantly, their suitability as a place for the retired and elderly to live.

Cross tabulations by city or town size find some surprises as well as striking differences. (See Table III.) For instance, when averaging the 13 characteristics, the findings show that suburbanites do not rate their own

Table I. How we rate our neighborhoods

Neighborhood characteristic	Overall Rating	Percentage Giving "Excellent" Rating
Place to raise children	B+	48%
Quiet	B+	45
Right amount of privacy	B+	41
Friendliness of neighbors	B	40
Place for retired and elderly	B	39
Safe place to walk at night	B	39
Well kept homes & apartments	B	39
Cleanliness of streets	B	38
Quality of public schools	B	30
Convenience to good places to eat	B-	30
Amount of traffic	B-	28
Place for young, single people	B-	27
Amount of police protection	B-	26

*The Merit Report: A Public Opinion Survey, sponsored by Merit cigarettes, had its beginning in September 1981. Bi-weekly it asks the public for opinions on current issues. The "quality of life" survey is the first "expanded" report conducted by the sponsor. Under the supervision of Audits & Surveys, Inc., some 1,201 adult Americans living in telephone households were randomly selected to participate in this scientific, nationally projectable survey.

neighborhoods as highly as those living in small town/rural areas and in smaller cities. Big city residents are found to be the least satisfied.

Inhabitants of large cities (population more than 200,000) are least likely to give their neighborhoods high marks as an excellent place to raise children, walk at night, for police protection, quiet or the quality of schools. Also, big city dwellers as well as suburbanites are least likely to rate their neighborhoods well for the friendliness of their neighbors. Surprisingly, big city dwellers are only slightly happier with their neighborhoods' convenience to good places to eat than are their less urbanized cousins.

Suburbs, however, do not fare much better than big cities — in spite of the relative affluence of their inhabitants. Specifically, suburbanites are less satisfied with the amount of traffic, the lack of friendliness, and the suitability as a place for young, single people or the retired elderly to live. They are, on the other hand, much more satisfied with the quality of their public schools than those living in other communities.

Small towns and rural areas win the highest marks from their inhabitants as excellent places to raise children, for the retired and elderly to live, for safety at night, the friendliness of neighbors, privacy, and quiet. Small town/rural area dwellers give their neighborhoods the lowest marks for convenience to good places to eat.

Moving from one's own neighborhood, the report reveals that Americans are in basic agreement when asked to characterize city, suburban or rural life in general.

The public was given statements such as "the pace of life there is too fast for me," and was asked whether the statement is true for life in big cities, medium to small cities, suburbs, small town or rural areas, or none of them. Possible answers also included a "no opinion" response. Each statement could be applied to [illegible] answers as are appropriate [illegible] city" and "medium to small [illegible] life if applicable).

In response to the fast pace of life statement, Americans overwhelmingly say it is true for big cities (77 percent). The reply is the same whether the respondents live in a rural area (79 percent) or a large city (73 percent).

Big cities are clearly seen as places that lack neighborliness. An overwhelming majority (77 percent) name big cities as places whose inhabitants "tend not to care about their neighbors." Again, this holds true whether the respondent lives in a big city (72 percent) or a small town/rural area (81 percent).

Finally, when given the statement "I can't understand why anyone would

Table II. How age affects the ratings

Neighborhood characteristic	18-34	35-49	50+
Quiet	40%	45%	51%
Privacy	35	41	49
Place for retired & elderly	30	39	48
Friendliness of neighborhood	35	38	47
Cleanliness	31	40	44
Well-kept homes & apartments	33	42	43

Table III. 'A' ratings by city or town size

Neighborhood characteristic	City over 200K	City 50K-200K
Place to raise children	36%	44%
Quiet	33	45
Right amount of privacy	33	40
Friendliness of neighbors	30	40
Place for retired and elderly	33	38
Safe place to walk at night	21	36
Well kept homes & apartments	40	38
Cleanliness	36	40
Quality of public schools	23	28
Convenience to good places to eat	38	36
Amount of traffic	28	31
Place for young, single people	29	30
Amount of police protection	20	31
Overall average	**31**	**37**

Suburb	Small town, rural area
48%	56%
44	51
39	47
30	49
29	46
36	50
42	38
38	38
37	32
34	21
24	29
20	28
30	25
35	39

want to live there," 53 percent of the public chooses big cities. Here, however, big city dwellers are far less likely to make this statement about their own environment (39 percent) than are small town/rural area residents (62 percent). Similarly, while 23 percent of big city dwellers can't understand why anyone would want to live in rural areas, only 11 percent of rural area inhabitants concur.

Just as a substantial consensus exists regarding the character of big cities, there is also a consensus regarding life in small towns and rural areas. A majority of Americans (58 percent) says "the pace of life is too slow for me." This is true of both big city dwellers (60 percent) and small town residents (51 percent).

Similarly, small town/rural areas are labeled as places where "there's not enough to do" by 63 percent of Americans. A total of 60 percent of people in both cities and small town/rural areas concur.

It is interesting to note that suburbanites, while less than satisfied with their own neighborhoods, perceive big city life as too fast (81 percent). They also turn up their noses at small town/rural life, with 68 percent labeling it as too slow and 70 percent saying there's not enough to do there.

The report also investigated the public's opinions about alternative places to live. Asked whether they would or would not move from their own neighborhood if they could live anywhere else in the U.S., half (49%) say they would.

"This finding," according to Treiman, "is consistent with the overall indication of substantial, but not overwhelming, satisfaction with one's own neighborhood. It may, however, have something to do with a restlessness that seems to be inherently American. Americans, for instance, move much more frequently than do people in Europe or Japan."

Although differences are only slight according to city or town size, the desire to move seems to correlate with age, marital status and income level. The young, single, high-income American is most likely to want to move from his or her neighborhood.

While 61 percent of people aged 18-34 want to move, only 33 percent of people aged 50 and older agree. While 62 percent of "single, never-married" people would move, only 47 percent of married people would do the same. and while 53 percent of Americans earning more than $25,000 a year would like a change of scenery, only 42 percent of those with annual incomes of less than $15,000 say they would.

Finally, the report posed two questions to those who would like to move. First, it asked whether they would choose a nearby neighborhood, another neighborhood in the same city but not close by, a different city in the same area of the country, or a different region of the country.

The findings reveal that more than half would like to move and would choose a different region of the country (56 percent). People in the Northeast (68 percent) and the North Central regions (63 percent) are significantly more likely to want to move to another area than are people in the South (46 percent) or the West (41 percent).

Second, the report asked people who want to move whether they would want to live in a big city, medium to small city, suburb, small town, or rural area. Overall, medium to small cities emerge as No. 1 (26 percent), followed closely by the suburbs (21 percent) and small towns (20 percent). Big cities (15 percent) and rural areas (16 percent) draw the fewest votes.

Perhaps not surprisingly, many people who would like to move seem to want neighborhoods similar to those they live in now. Thus, 53 percent of those living in a small town/rural area would move to a similar type of neighborhood, a plurality (40 percent) of suburbanites would live in another suburb, and a similar number (41 percent) of medium to small city dwellers would move to comparable surroundings elsewhere.

How reliable are the findings? According to the report, "one can say within 95 percent certainty that the accuracy of the results is withing plus or minus three percentage points of what the results would have been had the entire adult population living in telephone households been polled."

Copies of the full report are available by writing: The Merit Report, 120 Park Ave., New York, NY 10017. **ACC**

Municipal Cost Indexes

ACC's MUNICIPAL COST INDEX rose 0.3 percent from June to July to 317.8. The modest 4.1 percent annual increase continued the trend set last December when the MCI first dropped below an annualized five percent. Fuel prices continued to decrease sharply this month with both diesel fuel and No. 2 fuel oil leading the pack with 30-day drops of 6.8 percent and 6.7 percent, respectively. Lower prices for motor vehicles (passenger cars, trucks, etc.) were largely offset by increases in other commodities. ■

THIS MONTH'S MARKETBASKET

	Current Index	Percent Change From: Last Month	Last Year
Air Conditioners	142.8	0.4	4.6
Apparel	194.7	0.1	0.3
Asphalt Roofing	389.0	4.2	0.6
Books	118.5	0	4.7
Chemicals, Industrial	339.7	0.1	-5.1
Coal	539.3	-0.1	1.3
Concrete Products	300.3	0.1	0.9
Construction Machinery	350.8	0.3	2.7
Diesel Fuel	651.4	-6.8	-15.8
Electric Lamps	310.1	1.7	6.9
Electric Motors	303.2	0.1	3.5
Electric Power	409.5	-0.5	0.8
Electronic Components	180.1	-0.1	2.6
Engines, I.C.	340.4	0.5	5.9
Fans and Blowers	336.3	0	0.3
Fertilizers	260.0	0.2	-4.3
Floor Coverings	181.4	0.2	0.2
Footwear	248.4	0.2	1.5
Foundry Products	352.1	0.3	1.5
Fuel Oil No. 2	656.8	-6.7	-14.1
Furniture	286.7	0.5	2.5
Gasoline	564.4	-3.4	-11.1
Generator Sets	225.4	0.5	1.3
Glass	229.7	0	6.2
Glass Containers	353.8	-0.1	-1.2
Gypsum Products	271.4	3.0	3.1
Hardware	286.3	0.1	2.8
Heating Equipment	242.3	0.5	2.7
HVAC Controls	123.8	-0.2	7.4
LP Gas	708.6	0.1	27.5
Lubricants	353.9	0.1	0.9
Lumber	374.3	1.5	15.5
Metal Fabrications	302.6	-0.4	-0.9
Millwork	302.7	-0.4	9.4
Motor Vehicle Parts	351.5	-0.1	2.2
Mowers	252.3	0.2	9.8
Natural Gas	1447.4	-3.5	13.9
Office Machines	154.8	0.1	2.5
Paint	265.1	0	2.4
Paper	278.7	0	-3.7
Passenger Cars	216.5	-1.1	3.3
Plumbing Fixtures	287.5	0.7	2.6
Plywood	239.3	0.2	2.3
Portland Cement	330.2	1.0	-3.2
Pumps,	347.8	0	-0.1
Residual Fuel	1086.2	3.2	-8.2
Sand and Gravel	284.8	0.2	3.3
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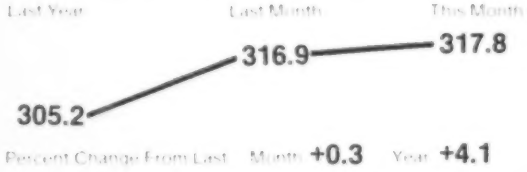
Struct. Clay Prod.	275.3	1.6	6.7
Switchgear	268.6	1.7	1.9
Tires and Tubes	246.6	-1.4	-2.7
Transformers	225.4	0.5	1.3
Trucks	317.6	0	5.5
Valves	100.3	0.3	-
Wire and Cable	205.8	-0.1	-0.6
Wiring Devices	331.9	0.3	2.9

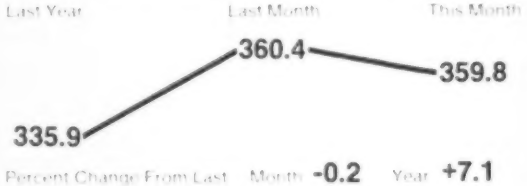
At-A-Glance Changes

ACC MUNICIPAL COST INDEX



Percent Change From Last Month +0.3 Year +4.1

ACC CONSTRUCTION COST INDEX



Percent Change From Last Month -0.2 Year +7.1

CONSUMER PRICE INDEX (BLS)

Percent Change From Last Month +0.7 Year +3.9

PRODUCER PRICE INDEX (BLS)

Percent Change From Last Month -0.1 Year +2.2

QUARTERLY MUNICIPAL TRENDS

	Current Level	Percent Change From: Last Qtr.	Last Year
Receipts	$440.5B	1.4	4.8
Federal Grants	84.2B	2.7	0.7
Durable Purchases	12.7B	1.6	4.1
Consumables	32.8B	1.2	4.8
Services	83.7B	1.7	7.9
Structures	42.0B	2.9	1.0
Salaries, Wages	228.4B	1.6	7.2
Surplus	+$32.3B	0.6	-3.6
Employment	13.007M	0	-1.2